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ABSTRACT

The purpose of this study was to survey current practices in training teachers to use audio, video, and computer technology in their classrooms, ascertain the usefulness of that training, and provide recommendations for the National Center for Education Statistics (NCES) surveys in the area of educational technology. The introduction briefly summarizes the purposes and rationale for the study as well as the data collection process. The major finding--a predominant concern with training that dealt with computers--is also noted. Section two provides an overview of the assumptions that underlie training in the instructional uses of technology. Examples of training efforts are used to illustrate how these assumptions influence the design and provision of training. The next section discusses the roles of the various training providers and gives annotated descriptions of local school district technology projects, statewide technology training programs, regional technology training and support programs, and national demonstration projects on how new technology can contribute to learning, development and education. The report concludes with a discussion of some research questions that should be addressed in order to systematically examine the assumptions around which training practices are built, and to assess how training and support activities affect the instructional use of information technologies in the classroom. An annotated bibliography, selected references, and a list of persons interviewed are included. A chart summarizing state government efforts to promote instructional computing is appended. (DJR)

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TRAINING OF TEACHERS IN THE INSTRUCTIONAL USE OF TECHNOLOGY

By

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March 1985

A Report Prepared for
CORPORATION FOR PUBLIC BROADCASTING
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and
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Foreword

As part of former Secretary of Education Terrell H. Bell's initiative in Educational Technology, the National Center for Education Statistics (NCES) cosponsored the development of this report with the Corporation for Public Broadcasting (CPB). Under a subcontract with CPB, Dr. Linda G. Roberts, a private consultant, conducted the research on teacher training in the use of instructional technology and developed a draft report. This final report has been extensively edited by Janice S. Ancarrow, Educational Technology Coordinator at NCES, who served as Project Officer for this study.

The purpose of this study was to survey the existing teacher training programs in the Nation today, and to provide recommendations for NCES's surveys in the area of educational technology. This report provides a synthesis of teacher training issues through an analysis of the generic assumptions underlying teacher training and the more specific assumptions underlying technology training for teachers. Examples of local, State, Regional, and National teacher training projects are described. An annotated bibliography is included. Among the recommendations contained in this report is a suggestion to examine systematically the assumptions around which training practices are built and to assess how those training and support activities affect the instructional use of technologies in the classroom. It recommends going beyond the limitations imposed by survey research (perhaps by using case studies) to examine: the effectiveness of various training approaches; the need for new training programs to accommodate new or rapidly changing technologies; and the impact of technology on teaching and learning.

It is NCES's hope that educators and administrators may benefit from this information. We welcome any comments from the field.

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Acknowledgments

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TRAINING OF TEACHERS IN THE INSTRUCTIONAL USE OF TECHNOLOGY

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I. INTRODUCTION

The approach of this study was to examine current practices of training teachers to use audio, video, and computer technology in their classrooms and to ascertain the usefulness of that training. A first step was to identify the assumptions about training and how training influences the use of technology. A second step was to examine how these fundamental assumptions can be tested and how they are implemented in the development of training programs and activities. Because technology is changing so rapidly, and because this is an exploratory effort to determine whether a need exists to conduct further research on training and utilization more fully, a review of the literature focused on findings and reports published within the last five years; and, more importantly, relied on selected interviews. These interviews were conducted with the researchers, developers, providers of training, and school practitioners to ascertain what had been learned, to identify research and demonstration projects that were likely to produce important information over the next year or two, and to identify the areas that need further exploration in surveys and research.

The most striking finding in my data gathering process was the predominance of a concern with technological training that dealt with computers. While it is clear from the 1982-83 School Utilization Study (SUS 83), sponsored by the Corporation

for Public Broadcasting and the U.S. Department of Education's National Center for Education Statistics, that -- in comparison with computers -- instructional television and audio cassette recorders are available and accessible to most classrooms in almost every school, when one talks about educational technology today with researchers, developers, principals and superintendents, teachers, and parents, the focus is on computers. At the same time, the use of instructional television is still relevant, and very much a concern of ITV coordinators, television producers, distributers, public broadcasting station educational directors, local school districts, and State media coordinators. Nevertheless, in searching the literature of most recently published articles and reports (through the ERIC database), I found that articles about television or other technologies (other than computer) dropped off significantly by 1979 and 1980; whereas, the citations on computers increased by more than an order of magnitude.[1/]

1/ To date, most of the videodisc projects have been developed for industry or for the military, and only a few in such areas as medical training. There are several experimental educational videodisc research and development projects under way, with several prototypes already available and in use or planned, including such as the efforts of the Harvard Educational Technology Center and "The Voyage of the Mimi" Project at the Bank Street College of Education. A number of educational technology leaders report increasing interest in the development of interactive videodisc. It will be especially interesting to follow the training of teachers in the use of these materials since they will involve audio, video, and computer technologies.

This finding is reinforced further in an informal assessment of national conferences that involve teachers and administrators (e.g. International Reading Association, Association for Supervision and Curriculum Development, Council of Teachers of Mathematics, etc.), where workshops, seminars, and special sessions on computers in the classroom proliferated. Furthermore, in the proposals that were submitted under the Department of Education's program "to demonstrate the use of technology to improve education," most dealt with computer applications. Of the 12 demonstration projects selected, one involves the development of interactive videodiscs; whereas, all the others focus on microcomputers. Nonetheless, all of these demonstration projects are developing teacher training components, integral to the implementation and use of technology in the classroom.2/

2/ These projects are described below in the section on National Demonstration Projects.

II. SYNTHESIS OF TEACHER TRAINING ISSUES

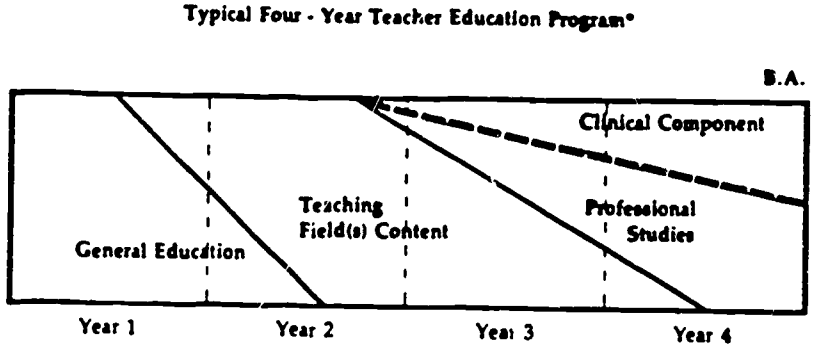
Today's teacher training programs and their next-generation improvements are based upon a set of often unstated assumptions. In examining the underlying basis for preservice and inservice training in education, it is useful to state these assumptions explicitly and then to differentiate between those assumptions generically associated with teacher training and those assumptions that are technology-driven.

A. Basic Generic Assumptions

The first assumption is that training is an essential component in the preparation of a teacher, and as such, this training has largely been the responsibility of teacher training institutions. The framework for preparing teachers in the United States has remained constant over the last 50 years. The preparation of teachers follows a typical pattern (see Figure 1) that includes general education, preprofessional studies, academic specialization, and professional studies. Training for teachers continues in the form of inservice education (continuing training provided by the local school district, State, or other institutions to keep teachers up-to-date) and through further graduate study or continuing education at colleges and universities (American Association of Colleges for Teacher Education, 1983).

A second assumption is that while the format and framework for training remain unchanged, the content of that training must change and evolve to reflect: (1) current school practices and organization; (2) research and evaluation of the teaching/learning process, which provide new knowledge and direction for practice; and (3) changing societal expectations and goals for schools. (Association for Supervision and Curriculum Development, 1984; A Nation At Risk, 1983.) These factors influence State-mandated teacher certification and curriculum requirement revisions and additions, which in turn directly affect the teacher preservice and inservice programs. As an example, 275 State task forces and committees have been formed to examine educational practices and standards, in response to changing societal needs, and more specifically, to the role to be played by education in an information age (A Nation Responds, 1984). As a result 28 States have revised certification standards, and 19 states have revisions under consideration or proposed.

Figure 1. Typical Training Program for Pre-Service Teachers



Source: American Association of Colleges for Teacher Education

B. Assumptions About Technology Training for Teachers

The first assumption is that the technologies create a new body of knowledge, information, skills, and tools and whenever this occurs the traditional assumption is that training must occur. The wave of training that followed the development of educational television series such as Sesame Street and The Electric Company, as well as many others, reflected this assumption. However, television was seen as more than simply a delivery system; and the need to use it to foster learner outcomes was embodied in the research and development of WNET's Critical Television Viewing Workshops (Abelman, 1984). A decade later, the focus has shifted to the developments that have evolved from the computer chip; and once again the focus is on new information, new skills, new tools, and new systems (Better and Miller, 1983; Bitter, 1980; Friedman, 1983; Hess and Miura, 1984; Office of Technology Assessment, 1982).

Today, however, a difference arises: computer applications are not seen as just another new technology. Thus, a second and related assumption is that the computer and related technologies have the potential to affect education in fundamental and far-reaching ways.

> "Because ideas can be presented, explored, and expanded by human interaction with the computer, computing is likely to transform the schools from kindergarten upwards; its impact will be as broad and deep as any intellectual innovation in recorded history, including printing" (Sobol and Taylor, 1980).

A third equally general assumption is that technological advances are creating unique demands and providing new opportunities for education. Many observers see technology and its application in education as an important catalyst for change that is long overdue. While technology and training are not the only areas of focus, they are seen as critical levers for the improvement of education in this country (Educational Technology Center, 1984; Griesemer, 1983; Schooling and Technology, 1983). For example, the need to upgrade science and mathematics curricula is a basic rationale behind the design and development of "The Voyage of the Mimi." At the same time, the producers hope to demonstrate the power of the technology, using dramatic and documentary video segments, interactive microcomputer simulations, and electronic databases on a videodisc, to help teachers and children approach science and problem solving.

A fourth assumption is that each new wave of technologies introduced into the classroom can generate alternate teaching and learning processes. Thus the development of new approaches, the creation of new roles, and evolution of new techniques are likely to be resisted by the practitioners of the traditional processes in place. Therefore, training provides a means to overcome resistance. Presentations that build awareness of the potential of the technologies in education, hands-on experiences with microcomputers or

videocassette recorders aimed at emphasizing their ease of use or "friendliness," demonstrations of classroom applications or simulations of implementation, and role playing are examples of training approaches employed to overcome resistance.

A fifth assumption is that while technologies have some features in common, each technology also has unique characteristics, incentives, and problems and that training must be designed to deal with these commonalities and differences. Most practitioners agree that all technology training requires hands-on experiences: If a teacher cannot find the switch to turn on the VCR or the disk drive, the power of the technologies is unavailable. On the other hand the interactive nature of computers and the resulting direct involvement of the user sets this technology apart from others. Perceptions differ as well: The negative perception of television and its predominance as an entertainment medium can be overcome by focusing on a series' educational content, and the valid goals and objectives, often through the production of teacher viewing guides. Demystifying the computer has meant that computers can become tools for "all" education, not just the domain of mathematics and computer science, where initial use and development originated. Thus, in one district the strategy to involve teachers from all disciplines in planning and creating microcomputer applications

to be used in the district-wide computer literacy program was actually a strategy for training and implementation (Roberts, 1983).

A sixth assumption focuses on the uniquely changing nature of the information technologies. Because the information technologies advance in a dynamic rather than a static process, training and staff development for technological literacy and competence must be continuous (Uhlig, 1983). Districts and state education agencies find that an evolving series of workshops and training activities literally keep adding on, and that one mini-course leads to another, and another, and another (Better and Miller, 1983). The inservice workshop and planning activities conducted in one year are outdated the next (OTA case study on Lexington, 1982). Not just computers are changing. The succeeding generations of educational television programming, video hardware formats, and distribution systems are also changing. "At one time you could identify an ITV production because it looked like what many thought teaching ought to look like. Training can provide the means to introduce teachers and administrators to ITV of the 80's--a Reading Rainbow, a "The Voyage of the Mimi," or a Chemical People" (Levine, 1984, Interview).

A seventh and related assumption is that technological advances are potentially limitless and that it takes a leap of faith and creativity to understand the potential uses in the

future. A dilemma is presented by this assumption since, at the same time, the need is to help teachers begin to use technology in ways that they are comfortable with, thereby overcoming resistance to change. How, then, does training prepare teachers to deal with the future without knowing what it will be? Workshops with leading technology and future experts, periodic brainstorming sessions, the Project BEST teleconferences, television programs such as Goodbye Gutenberg, and developing systematic long-range planning resources and processes, are based on this seventh assumption (Planning for Technology, State of Minnesota, 1983; Sobol and Taylor, 1980).

An eighth assumption is that technologies go beyond simply creating opportunities for new approaches and techniques. They fundamentally shift traditional teacher roles. Sheingold, et. al. (1983), documented the emergence of new teacher and student roles in response to the introduction of microcomputers in classrooms. Teachers became students and students became teachers. Increasingly, the development of highly sophisticated computer and interactive video technologies create the need to help teachers deal with a shift from the notion of "the teacher as expert and provider of instruction" to "the teacher as coach and facilitator of learning."

How to help teachers deal with these changes is not easily determined; but those who have observed and worked with teachers as they learn LOGO programming skills, or become

engaged in an adventure game, or master Bank Street Writer note that teachers can feel comfortable as learners (Goodson, Interview, 1984). The intensive two-week training sessions conducted by the Educational Testing Service for the IBM training project in Florida, New York, and California were based on this eighth assumption. As part of fostering this "exploring, learning" strategy, each participant was given a computer, to keep and use, at the very start of training (Schneiderman, Interview, 1984). These changes are so fundamental that at least a year of teacher training involving personal and intensive use of a computer should be required of all preservice teacher education programs (Bitter, Interview, 1984).

Training in the use of television has also been based on this eighth assumption. The development of the Critical Television Viewing Workshops focused on the medium itself as the subject matter and gave teachers new instructional strategies. These strategies were not simply talked about or demonstrated. Rather, training involved extensive role-playing and modeling techniques. similarly, in the Jumpstreet Humanities Project the training centered not only on new content interweaving literature, history, sociology and music, but also on creating questioning teaching strategies that would enable teachers to move from a "teacher-as-expert" role to a "teacher-as-facilitator."

It is the search for new understanding of these kinds of fundamental roles that underpins much of the research agenda currently being developed at the newly funded Educational Technology Center at Harvard University. Those who have been working with teachers and administrators, and developing approaches, sense the enormity and difficulty in fundamental role change, and in finding a training delivery system that effects that change. For it is not simply training that is involved. Training, they argue, is only a piece of the implementation strategy; the goals for curriculum, the organization of schooling, and the relationships with other societal institutions, such as the home, are other factors that must also be dealt with (Interviews with Beth Lowd, Lud Braun, Pat Sturdivant, and Inabeth Miller).

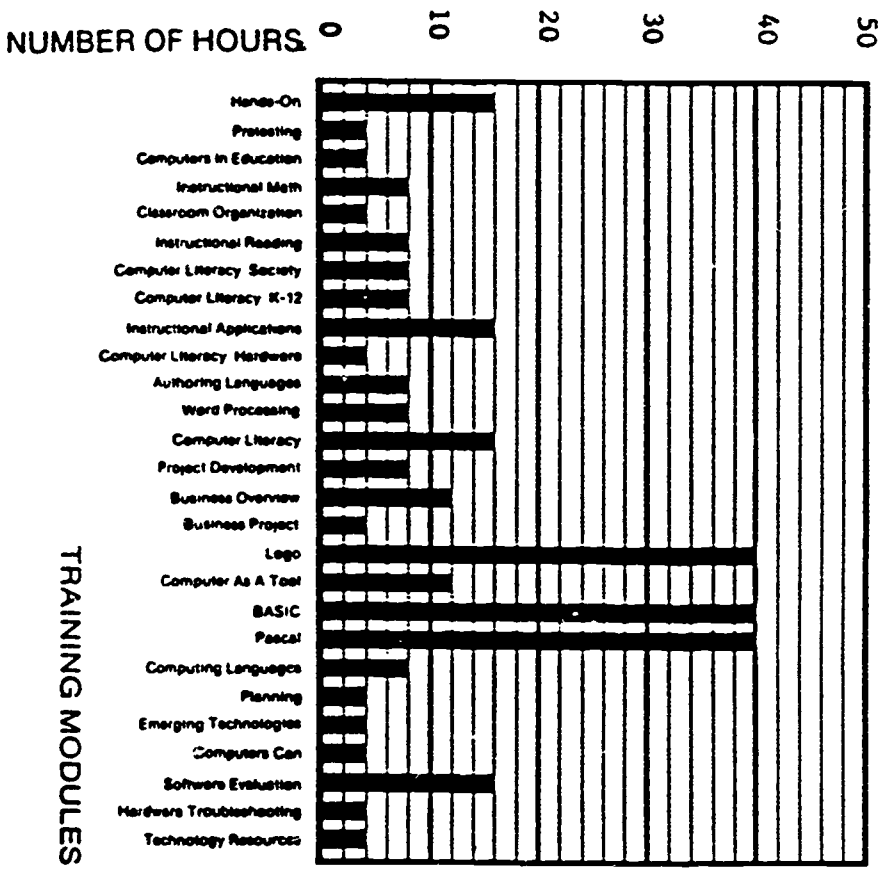
The ninth assumption is the tacit one that all educators must be technologically (computer) literate. Recently this assumption has become more sophisticated to take into account that not all educators need the same training. When one examines the training created for media specialists and media coordinators a decade or more ago, the same trends toward specialization occurred. As computers are implemented in classrooms, for a variety of purposes, and in a variety of settings, teacher training needs will become more differentiated. Do all teachers need to learn programming? An issue of considerable debate until recently, programming is now seen by

many as an option for those teachers who are interested and a requirement for those who will be teaching programming courses (Friedman, 1983). "Teacher technologists" in the Houston Independent School District are required to complete 296 hours of specialized training (See Figure 2). Specialized graduate programs in computer education, unheard of five years ago, are now appearing in many universities, with institutions such as Bank Street College of Education and Lesley College providing examples of how such programs can be developed.

A tenth assumption is that information technologies are shifting some traditional school roles to homes and other institutions. Little is known about the use of technologies in the home for learning. It is estimated that three to five million computers are available in homes, a far greater number than the numbers of microcomputers in schools (approximately 350,000). Moreover, Miller (Interview, 1984) points out that parents are not buying just games for their children; they are buying educational software products. New home products highlighted at the most recent Consumer Electronics Show were educational and innovative, and far more exciting than most of the software that is being produced for the school market. In this case, the impacts on schools are likely to be significant. The Household Technology Survey to be conducted by CPB may provide important information to educators. Similarly, the Harvard Graduate School of Education Technology Database

Figure 2

Specialized Teacher Technologist Training in the Houston Independent School District.



Teacher Technologist Training Sessions

Project may provide important examples of the educational use of computers and other emerging technologies in the home, museums, libraries, and other institutions.[3/] Based on this tenth assumption, new training and support will be needed as schools adjust to increasing numbers of students from technology-based homes.

C. How are the Assumptions Tested?

Given these assumptions and the evidence that they form much of the basic rationale for training of teachers in the use of technology, it is reasonable to ask how these assumptions are tested. One would expect that a body of systematic research and survey data supports the assumptions. After an extensive review of the literature and interviews with researchers, teacher trainers and school practitioners, I have to conclude that no such systematic underlying research has been done. What one finds instead is that these assumptions are based on the cumulative efforts and experiences by training

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3/ Recently, it was announced that Scholastic, publisher of Electronic Learning, Teaching and Computers, and Family Computing, has awarded a $700,000 grant to New York University, to conduct a two-year study of the impact of computers on the home. In Fall 1984, Scholastic will also initiate a weekly half-hour cable television series, "Family Computing."

providers--the local school districts, state education agencies, public television stations, ITV producers and distributers, computer hardware manufacturers, and colleges and universities. The assumptions are also based on feedback from those receiving the training and the observations and informal assessment of technology use in schools and in classrooms. The assumptions also derive from the negative impacts of providing no training: Without training, televisions gather dust in the corner of classrooms; new television series have few watchers; computers remain in boxes; and electronic mail and teleconferencing systems are under used.

Thus, in almost no instance does any systematic measure or follow up demonstrate that training based on these assumptions actually results in effective use of technology. It appears that most providers of training do not have the resources--time, funding, or expertise--to design and follow up training and systematically observe and track the use of technology following that training. However, findings from SUS 83 and other studies reinforce the overriding assumption that training supports the use of technology in our Nation's classrooms. At the same time, in examining these findings and understanding their limitations (e.g., the general limitations of any survey or of any controlled experiment in explaining the dynamics of

instruction and learning in classroom environments), we can develop additional research strategies.4/

D. Training in the Instructional Uses of Television

In the case of instructional television, the need for training is not seen as pressing. As an example, the SUS 83 survey asked teachers if they needed more training in the instructional use of computers. They were not asked if they needed more training in the instructional use of television. This may be due to the fact that video training has spanned more than a decade, and has included utilization presentations provided by public television station staff, inservice programs, and teacher guides provided by the television series producers, district-level workshops, teleconferences, and courses and institutes. Additionally, emerging video and broadcast technologies have evolved more slowly and are being adopted in elementary and secondary settings more cautiously than are computers. At the same time, however, producers and public television stations often find that resources are limited. When funding is available, it is more likely to be used for production of new programs and, if possible, maintenance of ongoing support efforts. Thus, in the most

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4/ See Research Questions Related to Teacher Training, page 49.

recent example of funding for "The Voyage of the Mimi," additional funding for training had to be sought from additional sources.

Nevertheless, the information gathered by the School Utilization Studies conducted by the Corporation for Public Broadcasting provide extensive information about the use of technology; and in the case of ITV, some evidence exists that training has been an important factor in its use. In the SUS 83 survey, teachers who have had training within the last three years perceive more positive outcomes of ITV use than those who have had training but not within the last three years, and even more so than those who have had no training at all. Of those teachers who use ITV, almost three-quarters indicate use of accompanying teachers' guides. These guides are a major and very important training and support component because they provide instructional objectives, teaching strategies, and additional instructional resource materials (Kahn, Levine, and Wilson, Interviews, 1984).

E. Training in the Instructional Uses of Computers

In the case of computers, tremendous pressure is on local districts, states, colleges and universities to train. These pressures come from the rapid influx of computers into schools before the schools are ready, as well as the demands for training by teachers themselves who are interested in

learning about the technology and want to be able to make appropriate decisions about use. The need and desire for training have been documented in recent surveys and studies:

- 49% of all school districts indicated that they needed qualified teachers (trained) for improving computer-based instruction (NCES Instructional Use of Computers in Public Schools, Spring 1982).
- 82.6% of all teachers surveyed by NEA expressed an interest in taking an instructionally related computer course. Of interest to the teachers was learning about applications, operating a computer, and learning to program (NEA, A Teacher Survey NEA Report: Computers in the Classroom, 1983).
- 90% of the teachers in the SUS 83 survey indicated that they wanted more training in computers.

Given the enormous pressures on schools to acquire hardware and set up computer programs, the emphasis has been on getting things going. The evaluation of computer-related training, if undertaken, has focused on the immediate outcomes: Were teachers satisfied with the workshop, the course, or the session? Did it meet their needs? Was it likely to be useful as they returned to the classroom? What other training would they find helpful? Rarely has the evaluation gone further, examining what skills have actually been learned and used, what strategies have been carried back to classrooms, or what further changes, understandings, and needs have occurred over time?

The information on immediate perceptions as well as changing hardware (more user-friendly) and software (tool-based applications such as word processing and data base management; and content-related drill-and-practice, simulation, or problem-solving software) have shaped subsequent training sessions. For example, early "computer literacy" training meant learning to program in BASIC. For those teachers who teach courses in programming, such training is essential. However, trainers discovered that learning to program in BASIC was not easily accomplished by novice computer users, nor did all teachers believe that programming helped them to feel comfortable with computers. (See the case studies in Informational Technology and Its Impact on American Education.) Moreover, once software evolved, these same teachers needed to know how to use available software rather than how to program. Thus, training focus shifted to operation of commercial packages and to evaluation and selection of appropriate materials. The findings from SUS 83 appear to indicate (although somewhat indirectly) that this training has been useful: Computer-using teachers indicate little difficulty in operating the equipment and have found software that is useful.

F. The Need for Further Research

Using the "conventional wisdom" of what is working, training programs are largely shaped by the early users of the

technology. Moreover, it is these "early users" or "computer buffs" that often become the next generation of trainers. Their experiences, motivations, and predisposition and enthusiasm for technology often become the basis for training. Are the needs of the non-users the same as the users? In the NEA Survey: Computers in the Classroom, the comparison between teachers who use computers and those who do not, suggests that real differences that relate to interest and motivation may be found between these two groups. How might training be different if we had a better understanding of the needs and motivations of those less likely to adopt the use of technologies in their classrooms? The NEA survey data, although based on a small number of computer-using teachers vs. a much larger number of non-users, suggests an area for further study. (See later section on research.)

Another reason for the lack of hard data concerning training and the long-term use of technology in the classroom is that such data are not easily obtained. Training is one factor of many that may influence implementation. The classroom is a complex, interactive system; and technology use is affected by its organization (Amarel, 1983), by its culture (Romberg and Price, 1981), by teacher knowledge that goes well beyond technology (Char, 1983; Shavelson, 1984), and by the

nature of the students and the goals set for their learning. As Shavelson documents,

> There are contextual factors that encourage, discourage, or set limits on the kinds and range of instructional uses teachers may employ. District policies regarding amounts and kinds of hardware and courseware might influence computer use. School support and encouragement might affect use. And the students served might affect the modes of instruction employed. Selection and training decisions, then, might depend on the particular context in which instruction is delivered. (Shavelson, 1984).

So what we have in the way of technology training is a mix of implicit and tacit assumptions, practical reality, human interaction and feedback from the users of technology, and changing school practices. What training efforts might be, or what other approaches might be more workable are derived from leaps of faith, from inspiration, or are never tried at all.

III. THE PROVISION OF TRAINING

The previous section has provided an overview of the assumptions that underlie training in the instructional uses of technology. In the previous section examples of training efforts were used to illustrate how these assumptions influence the design and provision of training. Through workshops, courses, seminars, conferences, teleconferences, in-school planning and meetings, and through print and support materials, training in the use of technology is being provided.

A. The Roles of the Various Providers

SUS 83 provides a summary picture of the major providers of teacher training and inservice workshops for ITV, Audio-Radio, Computers and Other Media (See Table 84 in the Final Report). It is not surprising to find that the local school district is most often the provider of training for all media: 58 percent for ITV; 36 percent for Radio/Audio; 64 percent for Computers; and 59 percent for Other Media. State Departments of Education are the second most common providers of training, followed by the individual school building, university or college, and others. One exception is in the case of ITV, where public television stations or networks provide 29 percent of assistance to schools, which is below district and State agencies but above local building support.

In the case of training for computer use, colleges and universities, other providers, and State Departments of Education appear to have about equal responsibility.

Who are the other providers? Based on an examination of the training providers, it appears that these may be intermediate or regional educational agencies, such as BOCES in New York State, or a Regional Education Service Center in Texas. The "other" providers may also be private industry, such as IBM,[5/] local computer sales stores, or privately owned and operated training companies.

While training in the use of technology occurs first in college and university programs as students are prepared for teaching, or eventually administration, the major focus on training in the last three to five years has been on training beyond initial preparation, and on training that directly relates to the technologies that are in use or becoming available. With regard to computer training, training providers strongly agree that the expertise in their use has come--like the computers themselves--"bottom up." First,

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5/ Within the last two years, IBM has launched two major teacher training efforts. The first involved selected districts in New York, Florida, and California. It was planned and implemented by the Educational Testing Service (Interview, Schneiderman, 1984). The second effort currently involves more than 20 of the largest school districts in the United States and is being implemented by Bank Street College of Education and Florida State University (Interview, Shuler, 1984).

individual teachers, then schools, then districts have become leading users and experts.

The colleges and universities have lagged behind. Some believe that this situation has begun to change: One can point to several leading institutions of higher education such as Carnegie-Mellon, Brown University, and the University of Pittsburgh and argue that the programs being planned there far outreach any of the implementations currently under way in elementary and secondary schools. While these are not typical teacher training institutions, some indication is available that those institutions are moving ahead (not as rapidly nor in such a far-reaching way), as well. CPB's forthcoming Higher Education Utilization Study (HEUS 85) and the NCES Fast Response Survey of Teacher Training Institutions on the "Preparation of Teachers for Use of Microcomputers" should provide a much clearer picture of teacher education efforts in this area.

In my research for this project, I have focused on examples of the training under way at local, State, regional, and national levels. In the annotated descriptions that follow this section, one gets a sense of the kinds of training that are provided. As I stated in the introduction, one cannot help being struck by the extensive and concentrated efforts that are being directed toward training in the use of computers. What one sees in these efforts is a wide range of training activit s

that run from after-school workshops, to year-round intensive technical training; from training provided by people (largely teacher experts), to centers being established at a State or regional level to serve as a site for demonstration, selection, and evaluation of hardware and software; and to a series of experimental training efforts funded by the Federal Government and the private sector.

In addition, a set of especially interesting and important technology research and development efforts is funded principally by the Federal Government. The Educational Technology Center at Harvard, and the Center for the Social Organization of Schools at Johns Hopkins University, both funded by the U.S. Department of Education and the Center for Children and Computers at the Bank Street College of Education, are examples of such efforts. These examples are included in the next section.

B. Examples of Local School District Technology Projects

The following four examples provide a brief description of the training and staff development approaches that have been undertaken in many districts. These four districts are also sites where the utilization of computers is high, with a continuous development of programs and ideas.

Cupertino Union School District
Vista Drive
Cupertino, California
(408) 252-3000

Mrs. Bobby Goodson, Computer Coordinator
Mrs. Jennifer Better, Curriculum Coordinator

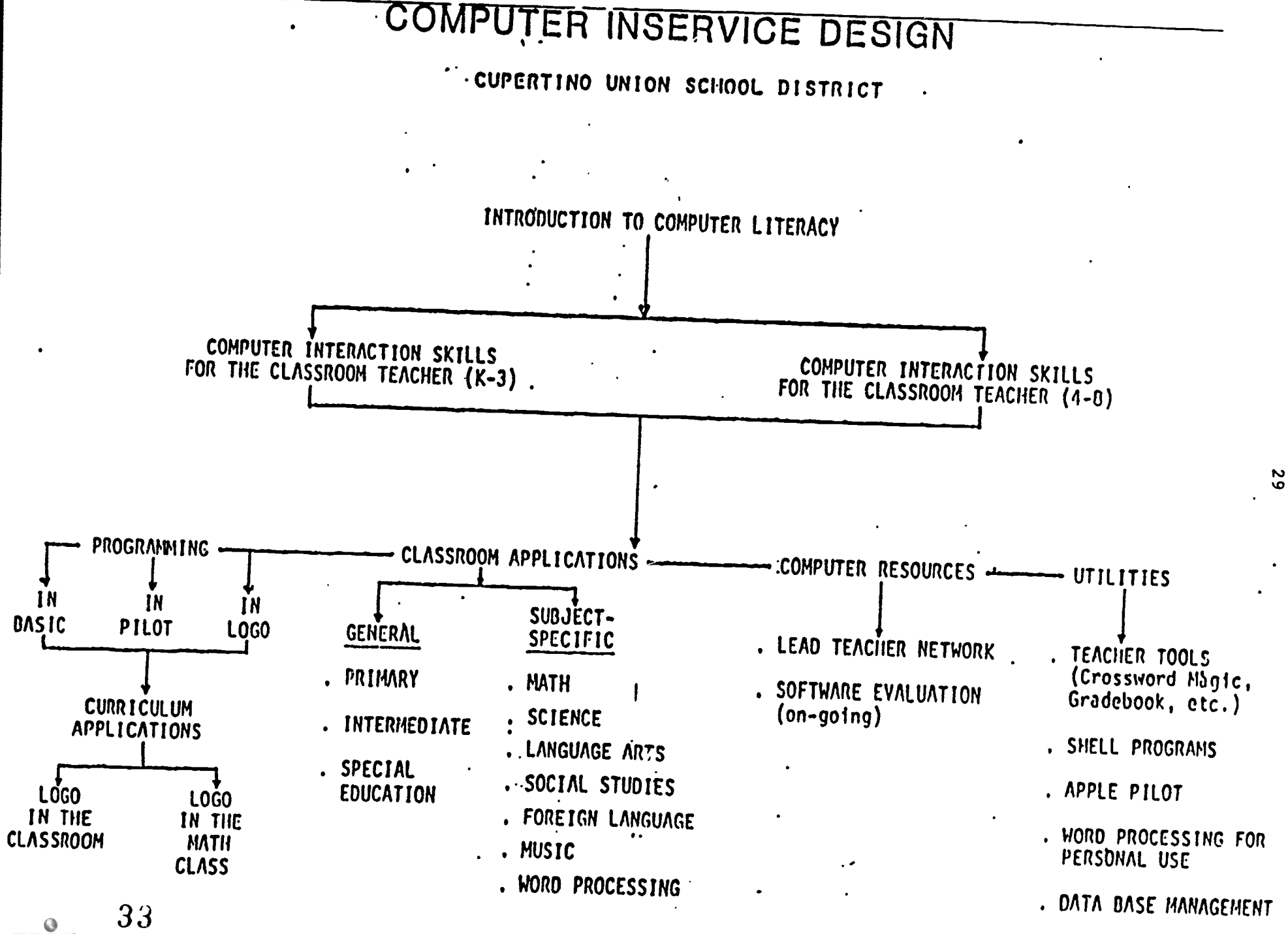
Cupertino computer literacy and computer-assisted learning activities have evolved over a six-year period. In the heart of the Silicon Valley, Cupertino is a district that has been able to draw on unique resources of the region. For example, with each new advance in hardware created at Apple, the district h , been able to try out new options before they go to the market place. However, it is their inservice training program that has been cited as a model by many other distric.s. Beginning with only one two-hour, after-school workshop, designed as an "introduction," the district has since created and offered more than a dozen inservice workshops on programming, classroom applications, productivity tools, and software evaluation and design. (See Figure 3, Co puter Inservice Design.) More than 90 percent of the district teachers and a ministrators have voluntarily participated in the workshops. Beginning with one self-taught computer teacher, the district now has several expert teachers (locally trained) who are now teacher trainers and "lead" computer teachers in their own schools.

Houston Independent School District
Department of Technology
5300 San Felipe
Houston, Texas 77056
(713) 960-8888

Mrs. Patricia Sturdivant, Associate Superintendent

After a decade of experience with computer-assisted instruction (CAI) operated through a t: share instructional network, the district sought to create a district-wide, cohesive educational program involving microcomputers. A new division was established, an Associate Superintendent hired, and a systematic, long-range plan was developed. The Department of Technology oversees training which ranges from 24 to 296 hours for teachers and administrators. In 1982-83 more than 3,000 teachers and administrators received training including literacy, applications emphasis, content orientation, planning and managing technology resources,

Figure 3 Computer Inservice Design, Cupertino Union School District, Cupertino, California.



programming, and maintenance. More than 30 full-time staff are involved in the training, software development, hardware maintenance, and long-range planning activities of the Department of Technology. The district is also installing its own electronic networking and videoteleconferencing system to assist in training and teacher support activities.

Lexington Massachusetts Public Schools
1555 Massachusetts Avenue
Lexington, Massachusetts
(617) 862-7500

Mrs. Beth Lowd, Computers in Education Specialist
Dr. Frank DiGiamarino, Director, Long-Range Planning

In creating a five-year plan for computers in education, the district has involved teachers and principals from every school in the district. Training has been accomplished principally through informal after school workshops in individual buildings, yearly district-wide computer leadership conferences (which make use of experts from other districts and nearby universities), and most often through one-to-one contacts with teachers by the district computer education specialist. Lexington has also created unique training opportunities: (1) teachers plan, implement, and evaluate models of computer use in their classrooms in encouraging teachers to develop and implement models of computer use (e.g., using LOGO in grade 5, and developing simulations in physics, word processing in grade 3); and more recently, (2) Lexington has set up opportunities for teachers to take "mini-sabbaticals" to study, to create materials for computer applications in the classroom, and to plan with the specialist.

Lyons Township Secondary School District
La Grange, Illinois

Dr. John Bristol, Superintendent
Dr. Estella Gahalla, Director of Curriculum

The infusion of more than 200 computers, all at once, in this small secondary school district, the establishment of a district-wide curriculum committee, and the decision to train all teachers was part of this district's plan to upgrade the computer literacy skills of all students. In addition to two, day-long workshops, teacher training was

accomplished, in part, by accident. In determining that insufficient software was available to meet the district's computer application needs in all content areas, the district established "software development teams" composed of classroom teacher planners, two college student programmers, and one teacher/computer consultant. These teams worked together intensively over a 6-week period; and by the time they were through, 45 teachers had learned a great deal about computer applications, were knowledgeable about software, and had a good understanding about both the potential and the limitations of use in their classrooms. (See Figure 4.)

C. Examples of Statewide Technology Training Programs

Alaska State Department
Office of Educational Technology and Telecommunications
Pouch F
Juneau, Alaska 99811

Dr. William Bramble, Director

The State's involvement in technology is pervasive, going back to the early 1970's with experimental and later operational uses of satellite transmission, a Statewide electronic mail network, multimedia individualized courses, extensive use of broadcast television, and more recently extensive support and training for educational applications of microcomputers. OET&T manages the State's instructional television and audio conferencing system, known as the LEARN ALASKA Network. It also now sponsors an annual Statewide computer conference, has funded the design and development of the Alaska Computer Training Series, a computer literacy training package for educators (videotapes, computer software, and print materials designed for group or individual training), and also publishes Educational Technology Alaska, a comprehensive newsletter for Alaskans and other interested educators across the country. Training and support for teachers are provided through all of these activities.

California State Department of Education
Computer Education
721 Capital Mall
Sacramento, California 95814
916-324-1859

Frank L. Wallace, Computer Consultant

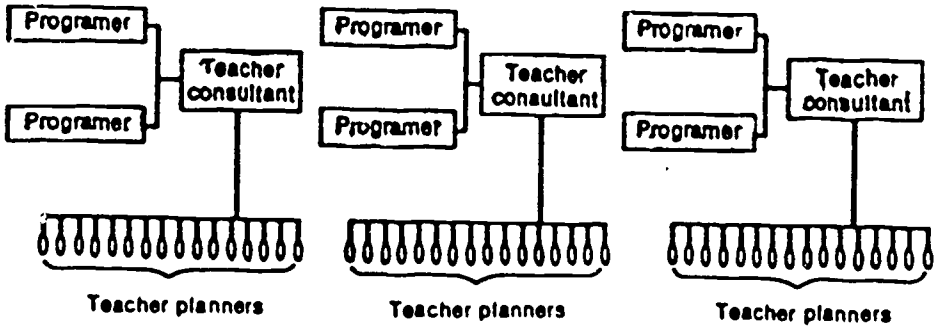
Mandated by legislation, training for teachers in mathematics, science, and computer education is offered through a network of regional authorities, Teacher Education and Computer (TEC) Centers. A TEC Center is located in each of the State's 15 regions. In the initial appropriation for the State's initiative, $4 million was allocated to the TEC Centers; approximately $4 million in grants to school districts for training and curriculum development was allotted; and an additional $1.2 million was set aside for exemplary projects. Each TEC Center has established its own network of local teacher consultants and experts, and the emphasis has been on providing classes for teachers (in some centers as many as 30 classes over a two-month period). In addition to the TEC Centers, a Statewide software clearinghouse operates out of the San Mateo County Office of Education, and a directory of software evaluations is periodically produced and updated under the direction of Ann Lathrop. Lathrop, a CUE member (see other listing) also runs the public domain software exchange, SOFTSWAP.

Computer-Using Educators (CUE)
Alameda County Office of Education
313 W. Winton Avenue
Hayward, California 94544

Glenn Fisher, President

Computer-Using Educators (CUE) is a non-profit California corporation founded in 1978 with the purpose of promoting and improving computer use in schools and colleges. Beginning with an informal group of 12 educators, CUE has grown to more than 8,000 members in 49 States, 4 provinces, and 12 other nations. CUE's main activities are a bi-monthly newsletter, several major conferences each year, and SOFTSWAP, an educational software library and exchange. CUE played a major role in the development of California educational technology legislation, the establishment of the TEC centers, and now the creation of new certification standards for computer education specialists. While CUE's major focus has been on the

Figure 4 —Software Development Model



SOURCE Lyons Township Secondary School District, La Grange, Ill

needs and interests of California educators, its conferences and the expertise of its key members and board of directors (Bobby Goodson, Cupertino Schools; LeRoy Finkel, San Mateo County Office of Education; Sandy Wagner; Santa Clara County Office of Education; and Glenn Fisher, Alameda County Office of Education) have gained national prominence and have been sought out by those who want to touch base with innovative, locally developed, "grass roots" activities. As an example, the Fall 1983 conference was attended by well over 3,000 educators, who participated in more than a hundred sessions, and attended commercial exhibits of the major hardware and software companies. CUE has spawned the development of similar groups all over the country. These computer-using educator organizations play a significant role in training and supporting teachers in the use of technology in the classroom. Some feel that this is a model for training that is far more effective than other more "traditional" approaches. Certainly that assumption would be an interesting one to test.

Florida State Department of Education
Computer Education Programs
Knott Building, Room 109
Tallahassee, Florida 32301
(904) 488-0980

Pristen Bird, Consultant

Florida is one of the earliest states to establish a computer policy: "It is the policy of the State to use computers and related technology to make instruction and learning more effective and efficient to make educational programs more relevant to contemporary society." Training, support services, and technical assistance services are provided through the State Department of Education and through the 28 teacher education centers, and 10 regional satellite centers. In addition to conducting workshops and training sessions, the program runs an annual computing conference, publishes a newsletter, maintains an electronic network which links computer-using districts, and develops documentation and support materials to aid in hardware and software selection and in programming and curriculum planning. Florida is one of the States that has a state-wide institutional arrangement with MECC (see later section) to provide educational software at nominal cost to districts.

Minnesota Educational Computing Consortium (MECC)
3490 Lexington Avenue North
St. Paul, Minnesota 55112
(612) 481-3500

Dr. Kenneth Brumbaugh, Executive Director
Mr. Don Rawitch, Director, Instructional Services

With more than a dozen years of experience in implementing and operating one of the largest instructional time-sharing computer systems, installing more than 10,000 microcomputers in Minnesota elementary and secondary schools, providing extensive training through workshops, on-site seminars, print documentation, and in creating several hundred instructional software packages, MECC is recognized as the leading Statewide educational computing agency. Its training, software, and expertise has been provided to Minnesotans, but also to educators throughout the United States and in other countries. Just recently, MECC has become a non-profit corporation, partly in response to a significant decrease in State legislative funding. However, MECC training services and software development are expected to continue to expand throughout the Nation.

Mississippi Authority for Educational Television
3825 Ridgewood Road
Jackson, Mississippi 39211
(601) 982-6565

Savan Wilson, Director of Education

Currently, 120 educational television series are broadcast from 7am - 4pm daily, providing approximately 2800 programs to all sections of the State. The Authority continues to play an active role in the development of ITV programs, and 35 of its series are distributed nationwide. Six full-time utilization specialists provide inservice training and support to schools and communities. Services also include print materials that describe each program, a scheduling and planning manual, and a newly created Skills Index, which matches TV program objectives to State skill objectives. While not the only source of training in the use of computers for the State, the station has taken an active role in providing a variety of TV programming series that deal with computers: THE NEW LITERACY, MAKING IT COUNT, THE COMPUTER PROGRAMME, READY OR NOT (produced in conjunction with North Carolina), and THE COMPUTER BREAK. In addition, the station has joined the EPIE

Project (see later listing) to assist teachers in selecting hardware and software. It is also developing an interactive video computer program in a project jointly under way with Kentucky Educational Television and another related project with South Carolina. Wilson sees these activities as part of the need to broaden technology programs and services and at the same time continue to provide the needed training and support that facilitate use of instructional television.

North Carolina State Department of Education
Educational Media and Technology Programs
Raleigh, North Carolina 27611
(919) 848-4360

Mrs. Elsie L. Brumback, Assistant Superintendent for Educational Media and Technology

Both educational media and computer technology are coordinated by the same unit in the North Carolina Department of Education, one of the few SEAs to have brought both traditionally separate departments together. North Carolina's technology activities have received national attention. In the last session of the legislature, $5.6 million was allocated for hardware, software, maintenance, and teacher training. The State is requiring every teacher in North Carolina to have a core competency in computer literacy within the next three years. The State advisory committee on certification also expects to recommend specialized training and certification requirements for teachers who are designated as computer teachers in a school. Seven new positions in the media and technology program have been approved to carry out these new initiatives. The State currently supports 55 educational television programs through open broadcast and is working toward creating an extensive videocassette distribution system to meet educational television needs across the State.

WNET/Thirteen Educational Division
356 W. 58th Street
New York, New York 10019

Stephen L. Salyer, Director
Additional Contact: Susan Newman
(212) 560-6673

WNET provides an example of new directions being explored and undertaken by public television stations. After a

year of planning, WNET has established a laboratory for applied research and development of model educational software using new information technologies. On March 4-5, 1983, the Center convened a group of twenty-four leaders from the fields of education and learning theory, software and hardware design, publishing, media production, and philanthropy to help set new directions for the laboratory. The results of those deliberations are in a report entitled, "Education in the Electronic Age." Initial projects include the development of interactive videodiscs using existing film footage to teach writing as a process, the establishment of a graduate fellows' program and seminar series, as well as the Software Design Professional Group. While not fully operational, the Lab represents an example of the new directions that are being considered by public television stations.

The Education Division also publishes Education and Technology Brief on a quarterly basis. This newsletter focuses on Learning Lab and other education division training and public television activities.

Other State Technology Training and Staff Development Efforts: The above projects were selected because they provide examples of the multitude of State efforts under way to assist educators to utilize technology in the classroom. Since the Corporation for Public Broadcasting publishes a directory of all public television stations, all of those stations and their activities are not discussed in this section, even though it is clear that these stations are significant providers of training and technical assistance in the use of instructional television. Similarly, it was not possible to describe all of the state computer training initiatives. However, at the conclusion of this Report I have attached the state-by-state summary that appeared in Electronic Learning November 1983, because I think this information may be very useful in planning future surveys or studies of technology training providers.

D. Examples of Regional Technology Training and Support

Northwest Regional Educational Laboratory
Computer Technology Program
710 S.W. Second Avenue
Portland, OR 97204
(503) 248-6800

Mr. Donald Holznagel, Director

The program has several ongoing projects including MICROSIFT, an activity which has developed criteria for software evaluation, and which evaluates software in 15 cooperating school-based centers located across the United States. MICROSIFT provides its quarterly evaluations to educators free of charge, or at cost, to cover reproduction. The Project also maintains RICE which is a data base of evaluations and projects (about 2400 entries), housed with BRS. Other projects involve the evaluation of junior high school level science software, as a part of the AAAS Science Project, and the development of speech synthesis and bar code devices to aid handicapped students (funded by the Department of Education). In the fall, a series of workshops for computer coordinators will be offered, focusing less on computers and technology and more on curriculum planning and development, and other maintenance and implementation issues.

Southeastern Regional Council for Educational Improvement
P.O. Box 12746
200 Park, Suite 111
Research Triangle Park, NC 27709
(919) 549-8216

Bernice H. Willis, Deputy Director

The Southeastern Regional Council conducts policy research for twelve southeastern State Departments of Education. Technology, its impact on education, schooling, and curriculum, and the policy implications have been a major focus of the Council research, conferences, and publications. Thus far, SCREI has published three volumes in its series on Schooling and Technology. The Council also provides a network linking teachers, local superintendents, state education agency officials, legislators, and members of the Governors' offices.

Center for Instructional Communications
Southern Educational Communications Association
P.O. Box 5966
Columbia, South Carolina 29250
(803) 799-5517

Reta Richardson, Director

SECA is an example of one of several regional organizations that provides services to member public broadcasting stations and serves the professional growth needs of its members. While most of its activities are ITV oriented, in recent years SECA has become involved in more broadly based issues concerning informational technologies and their impact on education. The organization conducts surveys of its member stations to determine changing needs and concerns, and fosters the sharing of ideas and information among members through conferences, reports, and informal networking. As an example, SECA's upcoming Summer Conference will focus on technology impacts on education, using North Carolina as a case study; a presentation about "The Voyage of the Mimi," and COLORSOUNDS, examples of new production thrusts; sessions on instructional delivery/distribution systems, ITV Utilization promotions, instructional production, instructional programming; discussions of the future of ITV in the next five to ten years; integration of instructional technologies into curriculum; new learning needs; and new distribution technologies and their impacts.

E. Examples of National Demonstration Projects

U.S. Department of Education
Division of Technology, Resource Assessment, and Development
400 Maryland Avenue, S.W.
Washington, DC 20202
(202) 254-5833

Dr. Frank B. Withrow, Director

Twelve projects which demonstrate the use of technology to improve education have received grants ranging from $80,000 to $150,000. These projects involve elementary and secondary schools in content areas of reading, writing, mathematics, and science. Teacher training and support activities for "visiting educators," as well as

the development of software and support materials are major components of these projects. Projects funded for 1983-84 are listed below, with a brief description of the project and the contact person:

A computer-based, higher-order thinking skills approach to compensatory education.

Dr. Stanley Pogrow, Project Director
University of Arizona, College of Education
Tucson, AZ 85721
(602) 621-5830

Computer assisted basic learning experiences.

Dr. Walter L. Powers and Mr. Gary Brandt, Project Directors
School District No. 271
311 North 10th Street
Coeur d'Alene, Idaho 83814
(208) 664-8241

Using technology to enhance physics instruction in high school.

Roy Unruh, Project Co-Director
Physics Department, University of Northern Iowa
Cedar Falls, Iowa 50614
(319) 273-2380
and
Jack Gerlovich, Project Co-Director
State Science Consultant

Department of Public Instruction
Des Moines, Iowa 50319
(319) 515-3249

Kentucky Technologies Project (interactive microcomputer and mainframe based network among 10 Kentucky school districts and the university.)

Glenn H. Crumb, Project Director
Center for Mathematics and Science Education
Western Kentucky University
Bowling Green, Kentucky
(502) 745-3442

Applying technology to secondary school writing. (Heavy emphasis on developing teacher training and implementation support components.)

David A. Zacchel and Susan F. Loucks, Project Co-Directors
The NETWORK, Inc.
290 South Main Street
Andover, Massachusetts 01810
(617) 470-1080

Technology applications in basic skills. (Heavy emphasis on training for utilization of technology, program development, and implementation in junior high/middle schools in three Massachusetts communities.)

Richard J. Lavin, Project Director
Merrimack Education Center
101 Mill Road
Chelmsford, Massachusetts 01824
(617) 256-3985

Improvement of problem solving and physical science instruction at the junior high/middle school level through the design and development of computer/video-based curriculum units. (Interactive videodiscs are being developed in a unique collaborative effort between the school district curriculum teams and the Digital Equipment Corporation design team in Bedford, Massachusetts.)

Douglas A. Russell, Project Director
Lynfield Public Schools
Main Street
Lynfield, Massachusetts
(617) 273-5544

A demonstration training program for microcomputers. (Involves an intensive inservice program provided by the Bank Street College of Education. Seventy-five teachers in a summer workshop will produce a curriculum guide, evaluated, revised in second year, and disseminated.)

Dennis S. Lynch, Project Director
Montclair Public Schools
22 Valley Road
Montclair, New Jersey 07042
(201) 783-4000 EXT 233

Developing computer center learning modules for secondary students. (Heavy emphasis on curriculum development, teacher training, and evaluation of student achievement.)

Robert Eicholz, Project Director
Houston Independent School District
3830 Richmond Avenue
Houston, Texas 77027
(713) 960-8888

Demonstration and evaluation of a comprehensive plan for teacher education in four extensively computerized schools--Waterford School, Provo Utah; Montezuma Creek Elementary, Montezuma Creek, Utah; Larsen Elementary, Oxnard, CA; and an urban school district. (An extensive evaluation design will electronically "trace" teacher development through the project activities, and track student growth in achievement, and teachers' ability to integrate computer- based instruction in the classroom.)

Joseph Lipson, Project Director
WICAT Education Institute
P.O. Box 1729
Provo, Utah 84603
(801) 375-3855

Learning improvement through technology: teacher training.

Marvin Koontz, Project Director
Fairfax County Public Schools
3705 Crest Drive
Annandale, Virginia 22003
(703) 698-7500

Primary grades reading project: development of an interactive video-based, in-service training program for reading teachers. Student and teacher programs will be tested in Wisconsin and made available for national distribution through AIT.

Thomas DeRose, Project Director
Educational Communications Board
3319 Beltline Highway
Madison, Wiscon 53713
(608) 273-5532

Apple Education Foundation

Apple Computer Corporation
20525 Mariani Avenue
Cupertino, CA 95014
(408) 973-2102

Dr. Barbara Bowen, Director

The current Apple Education Foundation projects are the result of Apple's needs assessment survey of professionals in computers and education. These respondents overwhelmingly identified inservice teacher education as a priority need. The funded projects (hardware donated from Apple) provide sites for study of "the impact of training on use of technology, as well as sources of data on the marriage of technology applications in the classroom and learning theory derived from research." Thus, projects selected for funding had to demonstrate a strong school-university collaboration and partnership. Current projects include:

Creating and using local history databanks: University of Hartford and Glastonbury, Connecticut Schools;

Cooperative learning with microcomputers: University of Minnesota and St. Louis Park Schools;

Curriculum-based microworlds (simulations and reactive computer environments): University of Oregon, Center for Advanced Technology and Education and Eugene Public Schools;

Microcomputer-based communications network of rural writing teachers: Middlebury College and four rural school districts in Maine, New Mexico, Illinois, and New York;

Writing across content areas: Ohio State University and upper Arlington Public Schools;

Developing writing and word processing skills through microcomputers and access technology: Vanderbilt University and the Tennessee School for the Blind;

Microcomputers for dyslexic students: Johns Hopkins University and Jemicy School;

Teaching geometric relationships through LOGO: Emory University and Atlanta City Schools;

Classroom applications and curriculum development: San Francisco State University and 20 California School Districts;

English fluency via computers: Heritage College, Yakima Tribal School, and Ziilah High School;

Microcomputers as a communication alternative for autism and other severe communications disorders: University of Houston and Brazosport Texas Independent School District;

Electronic bulletin board among students, teachers, parents, and community members: Claremont Graduate School and Claremont Unified School District;

Tools for problem solving: Kearney State College and Holdrege School System;

Microcomputers as laboratory tools: University of Southern Colorado and Pueblo School District No. 60;

A computer network for gifted science students: 14 Rural North Carolina School Districts and Western Carolina University;

Industrial and technical applications using microcomputers: 3 Rural High Schools and Northern Michigan University.

F. Major Research and Development Efforts

Center for Children and Technology
Bank Street College of Education
610 West 1112th Street
New York, New York 10025
(212) 663-7200

Dr. Karen Sheingold, Director

This is one of the leading research centers on how new technology can contribute to learning, development, and education. Current research projects focus on the use of

personal computers, electronic networks, and interactive videodiscs. A sample of projects follows. The Center has concluded a two-year study of the cognitive consequences of learning LOGO; an in-depth study of three district implementations of technology in classrooms; and a preliminary study of teachers' use of science and mathematics related software. The center is investigating the use and design of information-management tools for classrooms. Bank Street College and Florida State University are responsible for teacher training and implementation of the second IBM Schools project, involving the 20 largest school districts in the U.S. Steven Shuler is the project director from Bank Street.

"The Voyage of the Mimi"
Bank Street College of Education
(see above)

Sam Gibbon, Executive Director

The development of the broadcast television series, prototype microcomputer software, and interactive videodisc components was funded by the U.S. Department of Education. The series will be broadcast Fall 1984. The Project has continued with significant support from the private sector (CBS Publishing) to expand and market the microcomputer software and student and teacher print materials.

In addition, Bank Street has developed a proposal to conduct a study of teacher training in science and in the use of computer, video, and interactive systems technologies, embodied in "The Voyage of the Mimi." NSF has given tentative approval to this national project which will create and test training approaches and materials. The objectives of training are to (1) reduce teachers' fear of technology; (2) establish teachers' comfort in not knowing all the answers to science problems but being able to build strategies that lead to answers; and (3) focus on the interdisciplinary nature of the sciences and provide models that overcome traditional dichotomized textbook approaches. Present plans are based on the assumption that modeling attitudes and strategies with teachers is a viable approach. Additionally, the plans are to saturate teachers with content and technology. Intensive full-time training over two weeks is anticipated. Clearly, this is a project that should be watched closely. It might also be possible to create additional opportunities for research.

Center for Social Organization of Schools
School Uses of Microcomputers
The Johns Hopkins University
3505 N. Charles Street
Baltimore, MD 21218
(301) 338-7568

Dr. Henry Jay Becker, Project Director

This project surveyed a national sample of 2,209 public, private, and parochial elementary and secondary schools in the United States. The study employed a stratified sampling design, oversampling certain categories of schools in order to obtain the greatest detailed information about schools likely to have had the most experience with microcomputers, and to obtain a sufficient number of cases from non-public schools to enable analysis of their use of microcomputers. The initial survey (funded by NIE) to determine if a school had a microcomputer(s) had a 96% response rate between December 1982 and February 1983. Extensive data were obtained, however, from a follow-up 18-page questionnaire sent to the primary computer-using teacher of the school in Spring 1983. Becker is presently analyzing and reporting the findings of his data in a series of newsletter reports (five thus far). These reports contain extensive and useful information concerning how computers are being used, how schools are organizing for computer instruction, and the evolution of programs in more experienced vs. less experienced computer-using schools. Becker is currently planning a follow-up survey with funding from NIE and NCES to begin Fall 1984.

Educational Technology Center
Harvard Graduate School of Education
Gutman Library, Appian Way
Cambridge, MA 02138
(617) 495-9373

Dr. Gregory A. Jackson and Dr. Judah Schwartz,
Co-Directors.

Funded by the National Institute of Education, the Educational Technology Center will conduct research over the next five years on the use of computers and other information technologies to teach science, mathematics, and computing more effectively. The Center is a consortium that includes the Education Development Center; Educational

Testing Service; the Newton, Ware, and Watertown, Massachusetts School Districts; the Children's Television Workshop; the Education Collaborative for Greater Boston; Interactive Training Systems; and WGBH Education Foundation. The central question guiding ETC research will be, "How can new information technologies be used to enrich, extend, and transform current instructional practice?" The ETC research will focus on computers, as well as school applications of existing videodiscs, the development of new school-oriented videodisc materials, and the educational integration of new technologies with television. As part of its operation, the ETC is providing teacher training workshops and seminars throughout the New England area. (See The Use of Information Technologies for Education in Science, Mathematics, and Computers: An Agenda for Research. Educational Technology Center, March 1984.)

Microcomputer Directory Project
Gutman Library, Harvard Graduate School of Education
Appian Way
Cambridge, MA 02138
(617) 495-4225

Dr. Inabeth Miller, Director

With funding from the U.S. Department of Education, the Directory of Microcomputer Projects is being updated and expanded. The 1982 Microcomputer Directory listed 900 different projects involving a variety of subject matter areas, principally in elementary and secondary schools. The current project will go considerably beyond and develop an on-line database about technology applications in educational institutions: schools, universities and undergraduate institutions, alternative learning centers such as museums, libraries, community centers and camps, involving the educational use of computers, cable, satellite, videodisc, and cellular radio. About 20,000 entries are expected to be mounted on a public utility, Compuserve, as well as available through DEC talk. The project will also highlight exemplary projects.

EPIE Institute
Teachers College, Columbia University
New York, New York
212-678-3340

Dr. Kenneth Komoski, Director
Ms. Ellen Bialo, Assistant Director

Beginning with a grant from the Ford Foundation, the EPIE software evaluation project has established an extensive network of schools and teachers who evaluate computer software in their classrooms. Moving to expand and institutionalize operations, EPIE has several state-wide contracts to provide technical assistance in the selection of hardware and software for schools, and in the training of teachers to use computers effectively in the classroom. EPIE provides bimonthly reviews of software and hardware products. In addition, it publishes The Educational Software Selector (TESS). TESS is a reference guide listing over 6000 educational software programs currently available and is updated quarterly. EPIE is now available to consumers through the CompuServe network, where both EPIE reviews and TESS information is accessed electronically. EPIE is an important example of new institutional entities that are evolving to support and extend the use of technology in education.

New York Institute of Technology
Old Westbury, New York 11568
(516) 686-7997

Dr. Lud Braun, Director Academic Computing Laboratory

Under the direction of Lud Braun, NYIT is developing a proposal to train teachers in the use of computers, to be submitted to the National Science Foundation. While not yet funded, this project is designed to address what Braun sees are training needs not currently being met; i.e., he estimates several million teachers need training. Current approaches are inadequate, and Braun proposes to use technology itself for training: the computer and software designed to learn about computers; video technologies to present dynamic concepts such as classroom applications; print for distributing facts and ideas economically; and telecommunications for trainee and trainer to communicate at a distance in an asynchronous manner and alleviate the need for face-to-face contact. NYIT already has experimented with electronic networking and teleconferencing in several of the technology-based training methods that it offers to students.

IV. RESEARCH QUESTIONS RELATED TO TEACHER TRAINING

As I have noted previously, the School Utilization Study (SUS 83) provides the most comprehensive picture of use, availability, and support of audio/radio, video, and computer technologies in elementary and secondary schools. The National Survey of School Uses of Microcomputers, conducted by the Center for the Social Organization of Schools at Johns Hopkins University, provides even more current and detailed information, although limited solely to an examination of the use of computers. The Center expects to conduct a second survey in the Fall of 1984 to compare changes in the school uses of microcomputers over the past year. The Center expects to receive funding for this research from NCES (Becker, Interview, 1984). In addition, NCES has recently collected data on teacher training in the use of microcomputers through its Fast Response Survey System. A sample of all teacher training institutions has been surveyed to determine the extent to which these institutions are offering courses and providing training in the use of computers. While responses to the survey have been received, the analysis of the data is not yet available (Wright, Interview, 1984). Finally, the HEUS 85 data should provide a very comprehensive description of instructional uses of video, audio, and computer technologies in higher education.

Once all of this information is collected we will have a more complete picture, not only of the availability and use of the technologies in elementary, secondary, and higher education, but also of how training in the use of technology is structured and provided in both preservice undergraduate education and graduate education and specialization. The information on current and evolving inservice training practices will be limited to what we already know from the SUS 83 survey. The need to continue periodic School Utilization Studies is obvious. Given the assumptions stated herein about the technologies and the reality of their continued change, national surveys on how such changes are reflected in availability, use, and support (including the provision of training to teachers), are very valuable.

However, even with all of the above, an important need is to examine systematically the assumptions around which training practices are built and to assess how those training and support activities affect the instructional use of information technologies in the classroom. Thus, several research questions and efforts are suggested below.

A. From Assumptions to Relevant Research Questions

The first set of questions should deal with the effectiveness of various training approaches as measured by

subsequent use of technology in the classroom. These questions are drawn from Assumptions 1, 4, 8, and 9:

- To what extent does the training result in the acquisition of new knowledge, skills, tools, and approaches?
- How effective are various strategies used in the training process, such as awareness-building presentations, hands-on experiences, demonstration and role modeling techniques, formal courses, after school sessions, intensive summer workshops, year-long training seminars, or one-to-one instruction by the media, by a computer coordinator, or by a fellow teacher?

While some information could be gathered by adding additional questions to HEUS 85 or to subsequent SUS surveys, other research is desirable. An obvious approach to gathering data would be to set up situations where teacher knowledge, skills, tools, and use are measured before, during, and after training, through focused interviews and through on-site observation. Such studies would also require an understanding and measure of other critical factors which are likely to

influence use, such as school and district goals for technology; teacher knowledge, attitudes and incentives; student characteristics; school and curriculum organization; and other support structures. While CPB might not have the resources to undertake such a study on its own, several projects that might be tapped into are funded by the U.S. Department of Education, and several are likely to be funded by the National Science Foundation. In addition, joint efforts with one or several State Departments of Education that have targeted teacher training and technology as top priority areas might be possible.

In addition, one could set up a series of controlled experiments to test the effectiveness of a number of approaches. For example, a year-long training program vs. a series of telecourses vs. no training; or hands-on experiences with computers or interactive video vs. teacher guides and software support materials. The problem with controlled experiments is that, if conducted in typical classroom and school settings, clearly separate control and treatment groups are often difficult to maintain. However, such experiments might be conducted more easily in preservice university settings and might provide important insights into training effects.

The second set of questions is drawn from the assumptions about the introduction of audio, video, and computer technologies affecting the traditional training process. These questions emerge from assumptions 2, 3, 4, and 5:

- To what extent have new approaches evolved from the nature of the technologies themselves?
- How effective are these new approaches?

We can all find countless teachers who have been "turned off" by traditional teacher training courses or workshops. Yet more recently, I have seen the teacher-principal teams huddled together in front of their microcomputers, talking, inputting commands, reacting, planning, thinking aloud, consulting with their instructor and other teams in the room, and helping and sharing ideas. Also, I have seen a single teacher so engrossed in programming a simple routine in BASIC, that two hours went by; and to her "it felt like a minute." What is happening to these people? What and how are they learning? What are they taking back to their schools and classrooms? Given the diversity of training efforts currently under way, CPB might want to systematically observe and analyze common and unique features of the training through a series of case studies. In addition, CPB might conduct focused interviews with teachers, administrators, and teacher trainers who have been able to

plan, implement, and evaluate training efforts, particularly those who have already received National recognition. The previous section of this report provides a place to start.

The third set of questions focuses on the continually changing nature of the technologies; i.e., the "first generation" of computing; the "second generation" of computing; the "third generation" of computing, etc.; and their impact on training, on teachers, on the classroom, and on students. These questions, based on assumptions 2, 3, 6, 7, and 10 are:

- Are new generations of technology training programs being developed or do they need to be developed?
- At the same time, will some or all of the present training programs become outmoded by these advances and by the changes in schools and in the learning process?
- What kinds of training approaches help teachers, administrators, and institutions deal with change?

The examples of the development of the MacIntosh computer by Apple and the hoped-for development of the Japanese "Fifth Generation" computers and expert systems illustrate my point. In this case, rather than modify people (literally train them) to be able to operate computers, the manufacturer has modified the hardware to make it fit the way nontechnical users

operate. In this case, training is in the machine, and in the software applications developed for use. Thus, training for teachers becomes associated not with the technology, but with the classroom situation itself. CPB might want to conduct a study to determine whether or not such evolutions of training can be traced for audio, video, or computer technologies, and the implications for future teacher training providers and teacher training needs.

Some school districts, as well as teachers in individual classrooms, appear to be able to adjust to these changes. These early innovators may provide important insights into the change processes. At the same time, it is important to identify those individuals and school districts for whom change has been slow or difficult. The factors or needs that are different in these cases, could be determined through an analysis of the case studies and further interviews.

B. Additional Questions for Future Waves of SUS

Future waves of the School Utilization Study ought to include specific items that clarify the nature of training provided and its impact on the use of technology in schools and classrooms.

It would be helpful to know more about the nature of training: (1) How long was training conducted (an afternoon; a weekend; all week; or all year)? (2) What were the approaches

used in training (hands-on experiences; demonstration; modeling; questioning; shared-team efforts; curriculum planning; or observation in classrooms)? (3) What do teachers feel that they learned as a result of the training, and how was that knowledge, skill, approach, or idea carried back to the classroom? (4) What additional help, support, or training do teachers need (getting started; making decisions about what hardware and software to use; troubleshooting problems; or planning for the future)? (5) How have teaching and instruction been altered or changed as a result of training? as a result of technology use? as a result of both training and use? (6) What additional support materials do teachers need (teachers' manuals; tutorial software; student materials; learning packages that can be applied in the classroom setting--e.g., teaching writing with word processing, teaching history with databases, problem solving in mathematics or science)?

While the technologies and their use vary, questions (as in the HEUS 85 survey) should be asked about all the technologies, so that one can make important comparisons and distinctions among audio and video; interactive video and computer; and audio and electronic networking.

Finally, given the apparent increase of involvement on the part of State education agencies and the private sector, examining how new training approaches are being implemented might be useful; e.g., the creation of regional centers; the

addition of computer technology design and development efforts at some public television stations (like WNET); the joint efforts between local districts and colleges and universities; and the joint efforts between local and state agencies and technology companies.

C. Additional Questions for HEUS 85

While the HEUS 85 survey items are comprehensive and very well thought out, several points may help to clarify even further the availability, use, and support for instructional uses of technology. Since the survey asks respondents to provide information about courses that incorporate the use of video and audio technologies, questions about computer courses might also be included. In particular, knowing about courses available for non-computer science majors would be useful; i.e., the title of the course; the department in which the course is taught; and the number of students enrolled.

In both the video/audio and computers for instruction surveys, respondents are asked to indicate the ways in which faculty, students, and administrators at the institution use the technology. While the questions in the video/audio survey clearly differentiate between faculty vs. student vs. administrator, several questions in the computer survey do not. In particular, 3d, 3e, 3g, 3j, 3k, 3l, and 3m could involve use by students, faculty, or administrators. If you

eventually want to draw out specific uses by faculty, you may not be able to do so with these questions.

In the faculty questionnaire, Section C, the role of computers in faculty research and publication is not assessed. This appears to be a serious omission. Section D has only two questions related to training. The assumption of these questions is that faculty are already using computers. Some faculty members may need help in getting started.

The ability to use computers and other technologies may involve a number of complex issues that are not easily addressed in a survey. Thus, it may be desirable to develop a series of case studies of institutions that are high users of the technologies, as well as institutions that are developing comprehensive and far-reaching uses of the technologies, to understand more fully what influences the use of technology.

ANNOTATED BIBLIOGRAPHY AND SELECTED REFERENCES

Abelman, Robert. "Children and TV: The ABC's of TV Literacy," Childhood Education, Vol. 60, January/February 1984, pp. 200-205.

This article reviews research on the impact of television viewing on child development and poses questions concerning the role of parents and teachers in influencing their children's use, understanding, and interpretation of television content. The efforts to assist teachers in teaching students responsible and critical televiewing skills and to use television as an instructional device in the classroom, have been largely successful. "As a result of their training, classroom teachers generally know how to use popular television as a basis for instructive discussion or the exercise of student skills." Abelman summarizes the findings from many studies and projects:

1. the development of critical thinking can be enhanced through the study and application of television in school;

2. basic comprehension skills can be extended and reinforced through analysis of television;

3. the use of the medium is highly motivating;

4. responsible use in the classroom can lead to responsible use and decision making at home.

The range of projects has demonstrated that in-school intervention can stimulate class discussion, enhance critical thinking, provoke serious thought about the medium, induce skepticism of advertising and entertainment messages, and influence what children do with TV information after viewing.

Amarel, Marianne. "Classrooms and Computers as Instructional Settings," Theory Into Practice, Vol. XXII, No. 4, Autumn 1983.

Drawing on common features of elementary classrooms, the author highlights those features most salient to the adoption of new curriculum resources. The effects of introducing computers into the classroom are discussed, drawing on the author's experience in evaluating the PLATO Elementary Mathematics and Reading Project. Also discussed is the changing role of teachers and the impact on this role that is played by the introduction of computers into the classroom. Amarel concludes that "the vast majority of schools are unprepared for the onslaught of computers; and if past

experience is any guide, the capacity of schools to make productive use of the new technology will take time to develop."

American Association of Colleges for Teacher Education. Educating a Profession: Profile of A Beginning Teacher and Educating a Profession: Extended Programs for Teacher Education. Washington D.C.: American Association of Colleges for Teacher Education, 1983.

These titles are reports of Task Forces that examine the historical contexts of teacher preparation and provide current frameworks for the knowledge and skills that underlie preservice and extended teacher education programs.

Association for Supervision and Curriculum Development. Using What We Know About Teaching. Alexandria, Virginia: Association for Supervision and Curriculum Development, 1984.

This book provides a comprehensive and retrospective review on what is known about teaching, through research, implementation and evaluation, from the leading experts and practitioners in the field of curriculum development and teacher training.

Becker, Henry Jay. "The Classroom Context of Microcomputers: How Different Schools Manage the Problems" and "The Social Context of Microcomputers: It's Not Just a Matter of Good Software." Papers prepared for presentation at the 1984 meetings of the American Educational Research Association, New Orleans, April 1984.

These papers consider what schools are doing with the computers that they now have, and what has made some schools more successful than others in using their limited amount of equipment, drawing on recent analyses of data from the national survey, School Uses of Microcomputers, conducted in January 1983. While it is theoretically possible for computers to be in use nearly eight hours each day, few schools report continuous use. One-fifth of secondary schools reported use of more than 5 hours per day; but typically, schools report use of 2 to 3 hours per day. Of the factors that affected increased use, location was important: Microcomputers in laboratory settings increased use. For elementary schools (more than for secondary schools), the best results occurred when groups of teachers and the school principal jointly planned the computer acquisition and organized how the computers would be used, in contrast to those situations in which a single teacher was the initiator. However, teachers' roles were very significant: Schools with computer-enthusiastic teachers had greater

involvement by more teachers, use by more students, use for more applications, more time in use at elementary schools, and more equity of use in secondary schools.

Berliner, David C. "The Half-Full Glass: A Review of Research on Teaching." In Using What We Know About Teaching, Association for Supervision and Curriculum Development. 1984, pp. 51-77.

This is a comprehensive review of research on teaching.

Better, Jennifer and Marilyn Miller. "Computer Literacy and Staff Development." Draft, 1983.

This article describes the development and implementation of the Cupertino School District Computer Literacy Project. Staff development programs have evolved to meet the needs of teachers and administrators, on the assumption that both groups play a critical role in the implementation of the program. Inservice courses offered by the district, and taught by district educators; a Lead Teachers' Network (designated lead teachers from each school site, and additional staff members involved in the computer programs meet once a month to discuss current research, materials and instructional strategies as well as to share successes and failures that occur in the classrooms and lab); and a computer practice lab for district personnel (open after school hours) are three major components of the district's activities.

Bitter, Gary G. Survey of Arizona Public School Practices and Needs for Computer Assisted Instruction. Tempe. Arizona: College of Education, Arizona State University, May 1980.

This study was initiated by the Working Group on Microcomputers in Education, at the College of Education, Arizona State University.

Brady, Elizabeth and Shirley Hill. "Young Children and Microcomputers: Research Issues and Directions," Young Children, March 1984, Vol. 39, No. 3, pp. 49-61.

This article reviews current research relating to young children and computers and concludes that "there is much more rhetoric than solid evidence," with findings that are based on very small samples, with few research controls, and largely homogeneous populations drawn from university settings. "Researchers have yet to answer the major question: What are appropriate experiences on microcomputers for young children?" With these limitations, more than two dozen research studies are discussed.

While teacher training was not a focus of any of these studies, several draw implications for training: Knowing about computers is a poor substitute for actual hands-on experience and computer competence; time and chance to explore, appear to be more valuable than taking a formal course. Beyond that the ability to be able to evaluate students' learning behavior and interpret such behavior, requires an even broader set of experiences and competence.

Char, Cynthia. "Research and Design Issues Concerning the Development of Educational Software for Children." Technical Report No. 14, Center for Children and Technology, Bank Street College of Education, 610 W. 112th Street, New York, New York 19925, 1983.

This technical report discusses findings from a field-test evaluation on three types of innovative software created at Bank Street College, which were produced as part of a multimedia curriculum package on science and mathematics for fourth through sixth graders. The Project will produce a television series, "The Voyage of the Mimi," microcomputer software, print materials and eventually videodiscs. The major field-test finding was the range of software use in different classrooms. The amount and the way software was used appeared to be influenced by: (1) classroom organization, the ratio between students and teachers, and the ratio between students and computers; and (2) teachers' prior training in and perceptions of science, mathematics, or computers.

Christen, Kate and Peggy Gladstone. "EL's Third Annual Survey of the States", Electronic Learning Vol. 3, No. 3, November/December 1983, pp 37-54.

In a special 18-page report of Electronic Learning's annual survey of 50 State education agencies and their involvement in instructional computing, EL found that "what began as a grass-roots movement has now become institutionalized," particularly in State government offices. Data for the survey were collected over a three-month period by telephone. Significant trends were (a) State mandated computer use through legislation; (2) State mandated inservice training; (3) establishing a coordinating function or office at the State-level; and (4) increasing funds at the State level for programs.

Dirr, Peter J. and Ronald J. Pedone. Uses of Television for Instruction 1976-77, Final Report of the School Utilization Study. National Center for Education Statistics, and the

Corporation for Public Broadcasting. Washington, D.C.: Corporation for Public Broadcasting, 1979.

This report presents the results of the first in-depth nationwide study of the extent to which television is used for instruction in elementary and secondary schools throughout the United States.

Educational Technology Center. The Use of Information Technologies for Education in Science, Mathematics, and Computers. Cambridge, MA: Harvard Graduate School of Education, Educational Technology Center, March 1984.

This piece describes the Center's proposed research agenda over the next five years to find ways of using the computer, existing videodisc and television materials, the development of school-oriented videodisc materials, and the educational integration of new technologies with television, to teach science, mathematics, and computing more effectively. A discussion of the critical issues, problems, and research strategies is provided in this 73-page document, developed in a collaborative effort involving experts from the subject matter disciplines, teachers, educational researchers, and specialists in educational applications of technology.

Foell, Nelson A. "A New Concern for Teacher Educators: Computer Literacy," Journal of Teacher Education, Vol. XXXIV, No. 5, September October 1983.

This article outlines (1) recent trends in preparing teachers to become computer literate and (2) the steps being taken in Arizona and North Carolina to provide training.

Forsythe, Kathleen. "The Human Interface: Teachers in the New Age", PLET, Vol. 20, No. 3, August 1983, 161-166.

Kathleen Forsythe argues that the role of technology in education is challenging and controversial, and that education can be enhanced and enlightened by educational technology. In examining the use of television for distant learning, as well as future trends for use of both computer and video technologies, the key to instructor use and acceptance is experiences that allow educators to actively master technology, control it, and use it for learning.

Friedman, Daniel. "The Impact of Educational Computing on Teacher Education," Journal of Teacher Education, Vol. XXXIV, No. 5, September October 1983.

This article discusses the impacts that computers are expected to have on classrooms and the assumption that these technologies differ from most contemporary tools and learning devices. They facilitate individualized learning and interactive learning, and uniquely provide immediate feedback to the learner. It proposes a model curriculum for teacher education at the undergraduate level and a new degree program in educational computing at the graduate level (typical of many efforts under way).

Griesemer, J. Lynn and Cornelius Butler. Education Under Study: An Analysis of Recent Major Reports on Education. Chelmsford, MA: Northeast Regional Exchange, Inc., 1983.

Provides a comparison and synopses of recent reports on education by the National Commission on Excellence in Education, the College Board, the Education Commission of the States, the Business-Higher Education Forum, the Twentieth Century Fund Task Force on Federal Elementary and Secondary Education Policy, the Paideia Group (Mortimer Adler), and studies by John I. Goodlad and Theodore R. Sizer. "The teacher and teaching emerge as fundamental issues underlying each of the reports." Recommendations include improved incentives (salary, career advancement, autonomy) as well as improvement of the teaching environment and teacher training. While not singled out by any of the reports, the advances in communications and information technologies and the use of computers as basic tools for acquiring knowledge, organizing information, and solving problems, are among the major forces creating the need for educational reform.

Hess, Robert D. and Irene I. Miura, "Issues in Training Teachers to Use Microcomputers in the Classroom: Examples from the United States." Draft copy of a report prepared for OECD, February 1984.

The authors summarize growth of computers in schools and the emerging patterns of use, where microcomputers are located, scheduled, and made available for use. The roles of professional organizations, the Federal government, and involvement at the State level are examined. The State role in developing curriculum requirements, teacher training and certification standards, and in developing curriculum and training is described. The authors point out that the need for training is one of the major concerns in educational computing, noting that microcomputers were introduced into a profession that was

untrained in their use. Initial training was not organized, and largely mirrored the grass-roots movement of computers into schools. More recently, both State and local districts are developing and defining training programs. The report also examines the impact of computers on teacher functions and roles, and software development. It ends with two examples of use in the Palo Alto area: (1) Cupertino Union School District; and (2) the Institute of Computer Technology, a joint effort among several high school districts and the industry-education council.

Houston Independent School District, Department of Technology. Information Packet, 1983. 115 Pages. Available from the Department of Technology, 5300 San Felipe, Houston, Texas 77056, Patricia Sturdivant, Associate Superintendent. (713-960-8888).

This information packet describes the HISD Technology Programs, Teacher Technologist Training Program, Computer Literacy Curriculum, and Congressional Testimony on Technology Issues Facing the Public Schools. One of HISD's priorities has been to provide district-wide coordination of all training activities, some 24 to 296 hours of training for teachers who work with computers. In less than one year, more than 3,000 teachers were trained in the district.

Kearsley, G., B. Hunter and R. J. Seidel. "Two Decades of Computer Based Instruction Projects: What Have We Learned?" THE Journal, January 1983, and February 1983.

This is a comprehensive summary of two decades of computer-based instruction projects and the research that accompanied those projects. Of major interest to this paper are the lessons learned: (1) computers can be used to make instruction more effective and efficient in a variety of different ways; (2) despite two decades of research in CBI, relatively little is known about how to individualize instruction; (3) the effects of major instructional variables which underlie CBI are not well understood; (4) major barriers to use come from institutional and organizational factors, and traditional teacher training--around content rather than the kind of thinking or problem-solving skills needed to use computers as tools; (5) the need for new courseware and techniques; (6) development of mechanisms to share CBI information and courseware; (7) CBI has had a significant effect on the entire field of educational research; (8) Federal support of CBI research played a pivotal role in development; and (9) the results of two decades barely scratch the surface; emerging technologies will have a significant impact on CBI.

Minnesota Department of Education. Planning for Technology. State of Minnesota, Department of Education, 1983.

This is a detailed, 94-page manual for local district technology planning activities, providing assistance in (1) determining how technology will be used; (2) selecting goals for implementing the use of technology in the district; (3) determining the means to achieving these goals, including teacher inservice training; (4) developing procedures to implement technology into the curriculum; and (5) planning procedures to evaluate and report progress towards technology goals.

National Center for Education Statistics. Instructional Use of Computers in Public Schools: Spring 1982. Washington, D.C.: National Center for Education Statistics, U.S. Department of Education, FRSS Report No. 14.

This report contains findings of a national survey conducted by the National Center for Education Statistics in spring 1982 to assess recent changes in computer availability and to ascertain instructional uses and needs from the school perspective.

National Education Association. Teacher Education: An Action Plan. Washington, D.C.: National Education Association of the United States, 1982.

Recommendations for needed changes in teacher education are provided. The report provides a profile of excellence for teacher education, discusses the major functions of teaching, and describes the learnings, skills, and field-based experiences required. This document provides a comprehensive description of the educational and training process.

National Education Association. A Teacher Survey NEA Report: Computers in the Classroom. Washington, D.C.: National Education Association, 1983.

The data and analysis of this report are drawn from a selected sample of 1,700 teachers who were members of NEA. In the Spring of 1982, survey responses were obtained from 1,208 teachers (72.5 percent response rate) about their knowledge of computers, instructional experience with computers, and their opinions regarding inservice training, school policy, and the effects of computer use on students. At the time of the survey few teachers used computers for instructional purposes (11.2 percent). Nearly one-fifth (20.8 percent) had received some computer training, usually from a college or university or from the local school system. Teacher interest in learning about

applications, operating a computer, and learning to program was high (59 to 56 percent) and 82.6 percent of all teachers expressed an interest in taking an instructionally related computer course. Of the many analyses of the survey data, comparisons were made between teachers who use computers and those who do not. The data suggest significant differences that relate to interest and motivation, differential support within the school environment, and demographic, sex, and age differences between these two groups. These latter findings however, must be viewed with caution, since the sample of users was so small--only 75.

Office of Technology Assessment. Informational Technology and Its Impact on American Education. Washington, D.C.: U.S. Congress, Office of Technology Assessment, 1982. The full Report is available from the U.S. Government Printing Office.

A series of case studies, focusing on the development of computer education programs at local, district, and State levels, were prepared for OTA by L. Roberts. These case studies appear in their entirety in the Appendix of the Report. In the development and implementation of computer education programs, teacher training and staff development played a critical role. While the approaches undertaken varied in each of the cases, they provide (1) important examples of current practices and (2) a framework for an analysis of future directions. The case studies developed were:

Computers in Education: Lexington Public Schools, Lexington, MA

Computer-Using Educators and Computer Literacy Programs in Novato and Cupertino California School Districts

Technology Education and Training: Oxford Public Schools, Oxford, Massachusetts

Computer Literacy Program: Lyons Township Secondary School District, La Grange, Illinois

MECC: A State Computing Agency

Instructional Computing: Houston Independent School District, Houston, Texas

Roberts, Linda. "The Computer Age Comes to Our Nation's Classrooms," Theory Into Practice, Vol. XXII, No. 4, Autumn 1983, pp. 308-312.

Drawing on a series of case studies prepared for the U.S. Congress, Office of Technology Assessment, report on Informational Technology and its Impact on American Education, the author examines implications for teacher training and program development.

Rockman, Saul, J.D. White, Leah Rampy. "Computer in the Schools: The Need for Policy and Action," Educational Technology, Vol. XXIII, No. 11, November 1983, pp. 13-18.

This article reports the outcome of an Agency for Instructional Television computer/video consortium project, involving 42 state, provincial, and local education and telecommunications agencies, which analyzed major issues of concern through a Delphi process. These respondents are the people "responsible for setting, influencing and or administering policies regarding the adoption and use of computers in schools." Their ranking of the needs and issues provides a valuable context for further research, analysis, and program development. Of the five major issue areas, questions about curriculum impact ranked highest, followed by courseware development, courseware evaluation, teacher training, and research, followed by impact of computers in schools.

Romberg, Thomas A. and Gary G. Price. "Assimilation of Innovations into the Culture of Schools: Impediments to Radical Change." Paper prepared for the NIE Conference on Issues Related to the Implementation of Computer Technology in Schools, February 19-20, 1981.

Innovators need to examine the cultural traditions that (1) surround work, knowledge, and professional relations in schools and (2) are likely to be challenged by the innovation. In addition, educators need to create systematic monitoring procedures to understand the complex interactions taking place. Given the in-place school structures, implementation of innovations like microcomputer learning are not inevitable. "It is naive to believe that: to be available is to be implemented."

School Uses of Microcomputers: Reports from a National Survey. Reports issued by the Center for the Social Organization of Schools, The Johns Hopkins University, No. 1, April 1983; No. 2, June 1983; No. 3, October, 1983; No. 4, January 1984; No. 5, March 1984; No. 6 forthcoming.

This series of newsletter reports presents findings from the 1982 survey of microcomputer-using schools and teachers across the country. Extensive analyses were undertaken by the

Project Director, Henry Jay Becker, from responses to an 18-page survey by the computer-using teacher in each identified school.

Shavelson, Richard J., et. al. "Successful" Teachers' Patterns of Microcomputer-Based Mathematics and Science Instruction. Santa Monica, California: The Rand Corporation, June 1984. N-2170-NIE-RC.

This is the final report of a systematic study of microcomputer-based instruction employed by public school teachers nominated as unusually successful in microcomputer use. The study analyzed the patterns of microcomputer use in relation to district and school policies for microcomputers, the organization and composition of classrooms, teachers' attitudes towards computers, and teachers' subject matter expertise and computer knowledge. Implications of the study focus on (1) recommendations for teacher training and staff development to help teachers incorporate microcomputer-based instruction into their teaching repertoire and (2) recommendations for improving the quality of instructional computer software. NOTE: This was the only study that systematically examined the relationship between the expertise and training of teachers and classroom use.

Sheingold, Karen, Janet H. Kane and Marie Endreweit. "Microcomputer Use in Schools: Developing A Research Agenda," Harvard Educational Review, Vol. 53, No. 4, November 1983, pp. 412-432.

This article reports on three case studies conducted to reveal how different school systems used microcomputers for instruction. Six trends emerged that raise important questions for future research: (1) access to microcomputers; (2) emergence of new roles in response to microcomputers; (3) integration of microcomputers into elementary classrooms and curricula; (4) quantity and quality of software: (5) preparation of teachers for using microcomputers; and (6) effects and outcomes of the instructional use of microcomputers. With regard to research concerning teacher training, the authors point to a whole range of issues. First, they point out that teacher preparation is not a simple task given the variability of teacher knowledge of, and interest in, microcomputers, as well as preparation that matches different instructional microcomputer uses and purposes. The authors recommend consideration of formal sources of learning, such as computer buffs and self-directed activities with computers. Also, a need exists

to examine the incentives for learning new skills, such as time, and resources, as well as self-improvement and other intrinsic factors.

Sturdivant, Patricia. "Issues for Educational Computing and Training," AEDS Monitor, (Special Issue on Education Computing, 1984.)

Based on Houston's experiences in training teachers and professional staff to implement the district's computer education program, Sturdivant discusses what needs to be done.

Taylor, Robert. "Learning Teachers," Draft Paper. Teachers College, Columbia University, February 1984.

This paper probes the basic assumptions concerned with how teachers learn. It discusses the implications for teacher training in computing. He argues that three kinds of learning opportunities must be given to teachers if they are to become and remain learning teachers with respect to computing: (1) all teachers need repeated superficial training; (2) selected teachers from each building and district need extensive training and experiences with advanced ideas in computing; and (3) all teachers must be periodically exposed to the latest ideas in computing.

Uhlig, George. "Dimensions of Technology Literacy in Teacher Education," Journal of Teacher Education, Vol. XXXIV, No. 5, September-October, 1983, pp. 2-9.

This article discusses ten technology issues which have impor[illegible] for teacher education: (1) Because technological advance is a dynamic rather than a static process, training and staff development literacy programs must also be continuous. (2) Different types of technological literacy will develop based on the specific needs of the teachers. (3) Information technologies will replace some teachers, create new specialists, and require specialized training for all teachers. (4) A major demand requiring new knowledge of teachers is created by the proliferation of software. (5) The new technologies will dictate new school organization and design. (6) Because of the "newness" some districts and teacher training institutions will make mistakes--great assistance with planning is needed. (7) The issue of equity among districts and regions is growing and must be addressed. (8) Telecommunications is shifting some traditional school roles to homes; new school roles will need to be defined. (9) Some impacts, such as privacy and information control are not

yet known. (10) Schools and society will need to address negative impacts and emerging problems.

United States Department of Education. The Nation Responds, Washington, D.C.: U.S. Government Printing Office, May 1984.

A report of recent efforts to improve education, on a State-by-State basis, these efforts followed the release of several major national reports on the critical status of American education, and the need for reform. More than 275 State-level task forces worked on education in 1983-84. The major focuses of reform efforts include curriculum reform, changed school organization, new high school graduation requirements, revised teacher preparation/certification standards, and professional development efforts. Nineteen states have proposed certification revision; 28 states have enacted or approved changes. Twenty-one states reported professional development programs for teachers under consideration or being proposed; 20 states reported programs that have been enacted or approved. Many of the reform efforts have focused on mathematics, science, and technology. Each synopsis of State activities, with selected examples of local initiatives, is followed by a contact and phone number, which is very useful for those who wish to gather further information.

United States Department of Health, Education, and Welfare. Proceedings of the Conference on Teacher Training in the Use of Educational Technology. Washington, D.C.: Federal Interagency Committee on Education, July 1978.

This report provides a good summary of the concerns regarding the use of technology and teacher training in the 70's. The report is useful as a basis for comparison of the discussion of the issues now seen in the 80's. Recurring themes include (1) the need for training that fosters the "use of the technology" as an instructional tool; (2) few teachers have had such training; and (3) the educational use of technology involves an understanding of the educational process: the unique characteristics of the teacher; the devices (television and audio visual media); the materials; the context; the learning arrangements; and so forth. "Formal preparation in colleges and universities, pre-service training must not only provide students with the latest equipment and materials but also the experiences in which they learn how to select, produce, utilize and evaluate a wide variety of materials...to restructure traditional audio-visual classes as an integral part of the teaching/learning process." (p. IX.)

Wagner, William J. "Giving wit' a Plan: The Training Component of the IBM Secondary Education Program." Teacher Education Quarterly, December 1983.

This article describes the development of the teacher training component for the IBM Computer Secondary Education Project, how the program was implemented in the California site, and the involvement of the local districts, the Santa Clara County Office of Education, and the cooperating institutions of higher education.

Wilkinson, Alex Cherry and Janice Patterson, (Editors). Classroom Computers and Cognitive Science. Orlando: Academic Press, 1983.

In their overview, the authors provide a conceptual framework for analyzing present goals of instructional computin and what they ought to be. At the same time they point out that no unifying theory captures the important criteria for making choices. In addition, tney highlight the need to link recent progress in linguistics, artificial intelligence, and psychology to classroom practice. Defining computer literacy, selecting and distributing hardware, training teachers, and assessing cognitive outcomes are crucial issues for merging theory and practice.

Winner, Langdon. "Mythinformation in the High Tech Era;" IEEE Spectrum, June 1984, pp. 90-96.

This article argues that the romanticization of the personal computer as a social panacea to blind society to the fact that without guiding wisdom even the best tool can be misused.

WNET, Report from the Learning Lab: Education in the Electronic Age. New York: Educational Broadcasting Corporation, WNET/Thirteen Education Division, 1983.

This is a report of a meeting, held March 4-5, 1983, of twenty-four leaders from the fields of education and learning theory, software and hardware design, publishing, media production, and philanthropy. The meeting was convened by WNET/Thirteen, to consider a proposal that WNET establish a laboratory for applied research and development of model education software using new information technologies. The report consists of a summary of that meeting and a series of papers on (1) Computer-Aided Instruction, Jacob T. Schwartz; (2) Tools for Electronic Learning, John Speely Brown; (3)

Educational Ideology and Computers, Judah L. Schwartz; and (4) On Computers, Teachers and Schools: the Infrastructure Necessary for Powerful Software, Karen Billings.

LIST OF ALL PERSONS INTERVIEWED

Henry Jay Becker, Director, Survey of Microcomputer Uses, Center for Social Organization of Schools, Johns Hopkins University.

Jennifer Better, Director of Curriculum, Cupertino Union Public Schools.

Pristen Bird, Computer Consultant, Florida Department of Education.

Gary Bitter, Director, Computer Education Program, College of Education, Arizona State University.

Tom Boe, Instructional Computing Services, Minnesota Educational Computing Consortium.

Barbara Bowen, Director, Apple Education Foundation.

Ludwig Braun, Director Technology Programs, New York Institute of Technology.

Elsie Brumback, Assistant Superintendent for Media and Technology, North Carolina State Department of Education.

Peter Dirr, Annenberg Project, Corporation for Public Broadcasting.

Sam Gibbon, Executive Producer, "The Voyage of the Mimi," Bank Street College of Education.

Bobbie Goodson, former President, Computer-Using Educators.

Donald Holznagel, Director of Technology, Northwest Regional Laboratory.

Vivian Horner, Former Vice-President for Programming and Development, Warner Communications.

Henry Ingle, Former Director, PROJECT BEST; Dean, College of Communications, California State University at Chico.

Gregory Jackson, Co-Director, Educational Technology Center, Harvard Graduate School of Education.

Linda Kahn, Marketing Director, NICKELODEON.

Toby Levine, Former Education Director, WETA.

Beth Lowd, Computer Education Specialist, Lexington Public Schools.

Jean Narayanan, U.S. Department of Education.

Susan Newman, Learning Lab Project, WNET.

Reta Richardson, Executive Director, SECA.

Nancy Roberts, Chairman, Computer Education Program, Lesley College.

Saul Rockman, Former Director, AIT, Director of Technology, Far West Regional Laboratory.

Martin Schneiderman, Director, ETS/IBM Training Project.

Judah Schwartz, Co-Director, Educational Technology Center, Harvard Graduate School of Education.

Richard Shavelson, Director, Education and Human Resources Program, The Rand Corporation.

Karen Sheingold, Director, Center for Children and Technology, Bank Street College of Education.

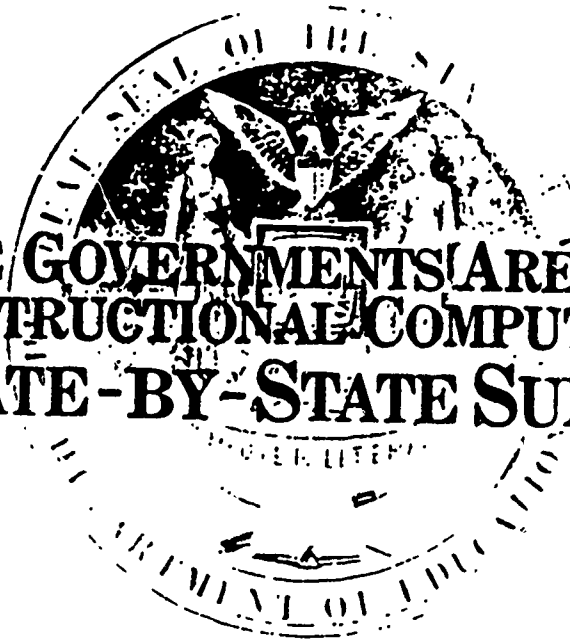
Patricia Sturdivant, Associate Superintendent for Technology, Houston Independent School District.

Steven Shuler, Director, IBM/Bank Street College Training Project.

Savan Wilson, Director of Education, Mississippi Educational Television Network.

Frank Withrow, Director, Division of Educational Technology, CLEI, OERI, U.S. Department of Education.

Douglas Wright, National Center for Education Statistics, U.S. Department of Education.



How State Governments Are Promoting Instructional Computing: A State-by-State Summary

STATE	MANDATE*	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Alabama	No; but State Plan Position Paper expresses intention that each student and teacher become computer literate. Implementation dependent on state funding. DOE** expects to approve minimum pre-service guidelines developed by universities.	Annual survey, June 1983 results: 1,000 micros in 27 districts. Expect figure to double within coming year.	Alabama Learning Resources Center (fall 1982) staff of two administers state-run programs, coordinates special DOE technology committee./Some state funding. Drafting proposals for discretionary grants with Alabama Council for Computers in Ed. and universities.	DOE committee devising masterplan for state. ALRC provides in-service and program planning workshops, district presentations, special interest groups. Reviews commercial software, offers evaluations or demonstrations; access to RICE reviews. Member, MECC. Plan to develop written, audiovisual in-service aids and electronic bulletin board. Plan statewide conference of regional meetings this fall. Hardware contracts available—coordinated with software purchases.
Alaska	No; DOE claims mandate is "not necessary," due to high level of interest statewide already.	April 1983 survey: for 91,000 students, 1,750 micros total. Estimate 650 additional micros in subsequent six months.	Office of Educational Technology and Telecommunications (ETT) (1981)./ State funding. 1982 marked end of five year National Institute of Education funding for school program development; total allotment, $3.2 million.	ETT recently developed comprehensive in-service training package of videotapes, disks and written guides to be administered by District Curriculum Coordinators—helps overcome travel restrictions. Also provides 2- to 3-day workshops; one in three teachers had participated as of June 1983. Maintains central software library, usually in transit with workshops; has helped develop extensive software collections in each school. Disseminates MECC and ETT's own high school courseware. Bi-monthly newsletter contains software reviews. Member, MECC. Dept. of Administration maintains hardware contracts.
Arizona	No; but Governor has requested that state universities offer equivalent of one semester's computer training to all Arizona teachers.	Annual survey, 1983 results: 623 schools (69%) responded; of these, 476 (76%) reported using computers for instruction; 1,054 micros total.	Coordinator of Computers in Educational Programs./State funding; budget includes salary only.	Coordinator's primary function defined as facilitating user networking, information-sharing. Administers awareness and introduction to programming workshops; coordinates DOE's other involved divisions. Districts use electronic bulletin board to air hardware and software concerns. Hardware contracts.

*"Mandate" is taken here to refer to requirements (or recommendations) applying to students and/or teachers within a state

**Department of Education. In this chart, DOE is used generally as an abbreviation for each state's education agency

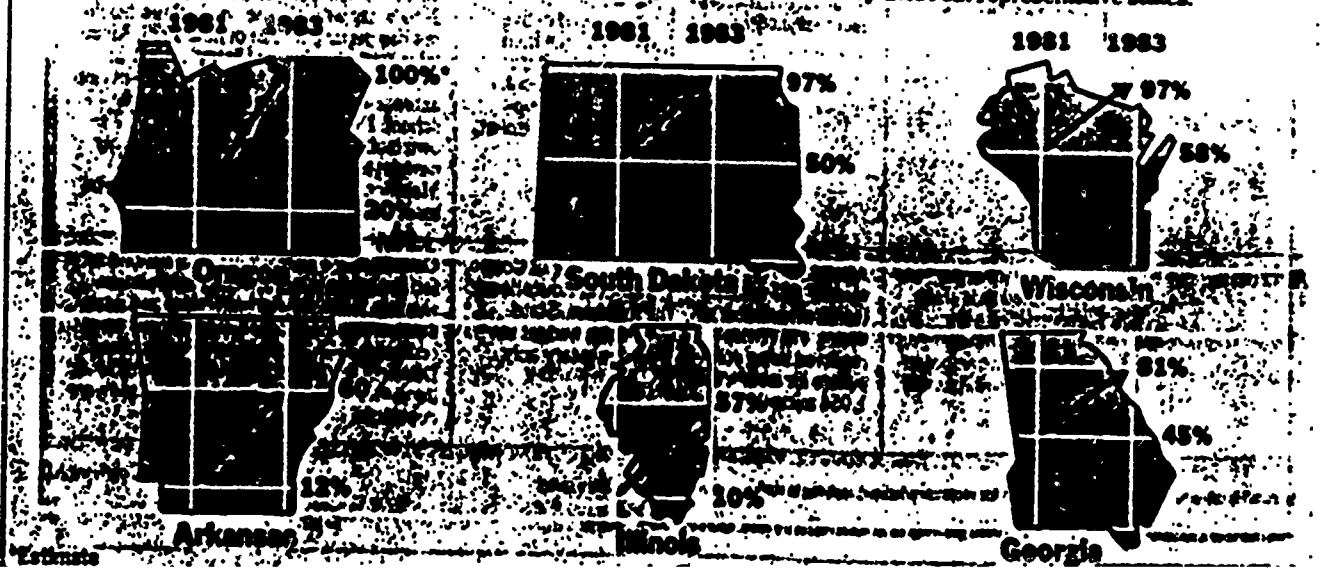
(Continued)

STATE GOVERNMENTS

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Arkansas	No; but March 1983 legislative action calls for revision of secondary student accreditation process. Proposed requirements that all high schools offer at least one unit of computer literacy; and that "Each student shall have appropriate computer instruction prior to completion of high school in accordance with guidelines developed by DOE." In-service and pre-service training are required.	Three-year sequential study released 1983: Of 370 districts, 355 responded, 215 owned at least one micro; 1,569 micros total.	Administrator of Instructional Computing now part of Office of Management and Development. Coordinates DOE activities, administers DOE Microcomputer Lab (MCL)./DOE budget appropriations, 1982-84 additions: [illegible] tion for development of basic skills project.	MCL stocks extensive hardware, software. Used for workshops developed around teacher feedback. Courseware information including evaluation checklist offered through workshops, also disseminates available courseware list and bibliography of pertinent literature. Special basic skills project will target use of micro in teaching grades 4-6 reading, math. DOE conducts pre-school year planning conferences at individual schools. Offers sessions in special interest conferences. Hardware contracts
California	No; but DOE "Model High School" graduation requirements include computer science course. 1983 legislative school finance and reform bill earmarks funds for DOE development of comprehensive K-12 computer studies curriculum, specifying skills students are expected to acquire at each grade level. Within next six months, advisory panel expected to present pre-service requirement recommendations to Commission on Teacher Education.	Comprehensive sample survey planned for fall 1983. 10,000 micros donated to California schools in 1983 by Apple Computer.	Department-wide task force coordinates efforts of Computer Education Unit (CEU) (branch of Technology Division, reorganized Jan. 1983), and activities of Office of Staff Development (teacher training) and of involved Divisions./ Chapter II funding, between $500,000 and $1 million yearly. 1982 legislation provided $9.9 million for teacher training and staff development; in 1983, funding given for computer studies curriculum development.	State-funded Teacher Education and Computer (TEC) Centers located in 15 regions, constituting statewide information network; each Center has regional in-service responsibility. Region 8 (San Mateo) contains software library and clearinghouse, runs software evaluation forum and produces Software Preview Guide (now disseminated nationwide). CEU maintains own software library, hopes to begin identifying areas of study needing quality software and to help offset production costs. Member, MECC. Participates in Computer Using Educators (CUE) conference. Negotiating hardware contracts. 1982 "Apple Bill" allows tax credit for companies donating computer equipment to K-12 schools.

Percentage Of Schools Within A State With Microcomputers: 1981–1983

The number of schools within each state that has at least one microcomputer for instruction or administration has risen dramatically over the past two years. This growth is illustrated by these six representative states.



STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Colorado	No; but DOE suggests "curriculum guidelines" in considering changes in teacher pre- and in-service requirements to include computing.	March 1983 survey: Of 181 districts, 80% responded, of these, 98.2% anticipated instructional computing in their schools by fall 1983 5,000 micros total.	DOE's two Technology Consultants (Oct. 1982) assist local districts, act as information, not personnel, coordinators for involved divisions' staff in instructional computing projects /Block grant funding.	Consultants provide workshops to districts, counsel local Bds. of Ed. on policy and program issues, facilitate user information network Often train district "core group" who then train others in region Developing DOE software library Provides statewide legislative hotline hookup Communicates with non-affiliated BOCES regional centers; contributes to statewide user group publications. Annual computer conference held jointly with U'S DOE. Hardware contracts.
Connecticut	No; but presently revising teacher preservice requirements Investigating possible "continuing certification" requirements for current teachers; estimate two years before formalized. In-service recommended.	1982 survey. In 165 districts, 4,000 micros reported. DOE estimates figure doubled by fall 1983.	Consultant for Computer Technology functions within Division of Instruction, Bureau of Elementary and Secondary Education, in unit composed of specialists in various technologies./Some state funding.	DOE activities reflect limited budget, local curricular control. Consultant acts in "clearinghouse" role; networking localities and potential in-service trainers, consults with districts introducing instructional computing to curricula. Disseminates software information; publishes DOE guides and software selection criteria; DOE newsletter "Micro Messenger" highlights MicroSIFT evaluations. Limited electronic mail. Member, MECC. DOE sponsors yearly statewide colloquium in cooperation with Taft Educational Center; offers sessions at professional association conferences; sponsors several regional conferences yearly.
Delaware	No; but state has made special allocation to DOE for development of literacy program. Bd. of Ed. presently recommends districts provide nine-week unit of instruction to all high school students, and consider computer science courses for all college bound students. All districts expected to run at least one in-service course by 1984-85 school year	1982 survey: In 16 districts, 1,080 micros total, 784 of these purchased in 1982. New survey was scheduled for October 1983 release.	State Council on Computer Education (reorganized 1977) acts as advisory group. State Supt. of Math is Executive Secretary of Council; coordinates DOE computer-related activities./State funding. Computer literacy program allocation: $300,000 for 1983-84. Legislature "fielding plan" for yearly unit funding of local districts.	Using computer literacy program allocation, DOE anticipates devising with each district a "computer literacy package" of hardware, software, training and evaluation materials to complement present district capacities and equalize "have" and "have not" districts. Council drawing up State Plan, asking 3-5 year plans from districts. DOE runs extensive in-service programs; estimates 55% of teachers have taken literacy course. Council organized, now cooperates with Project DIRECT, independent statewide consortium, provides software resources (special ed emphasis); member MECC; on-line electronic newsletter; hopes to set up software review panel. DOE sponsors annual computer fair. State agency hardware contract.
District of Columbia	Yes: Bd. of Ed. policy states: 1) student computer labs in all schools by end of present school year; 2) all students must demonstrate command of literacy skills before completing ninth grade, enforcement beginning 1987-88; 3) instructional personnel: 5-year recertification program requires every teacher to develop literacy and software selection skills; 4) pre-service: literacy required for tenure, starting 1983-84.	September 1983 data: 284 instructional micros in schools; additional 530 in state funded, 400 in federally funded student labs; 200 available for instructional management training.	puter literacy program administered by Office of Instruction. Two-pronged activity: Division of Program Development and Planning coordinates 5-year plan, focusing on hardware, software concerns. Instructional Services Center administers implementation, training. Computer Literacy Training Center./Regular budget $1.5 million; Chapter I funding $1 million, also funding from private sources (corporations).	Bd. of Ed. mandate is part of comprehensive 5-year literacy plan integrating labs, Training Center. DOE provides extensive in-service; has offered summer courses in literacy, BASIC, software selection and development at DOE and four satellite training labs. Has concentrated on 2-day workshops on instructional management for administrators and after-school literacy courses during school year. Developing software library and clearinghouse at main center, with evaluations. Use Supt.'s circulars to disseminate information; satellite centers expected to provide information networking in future. Binding hardware contracts.

STATE GOVERNMENTS

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Florida	Yes; 1983 state allocation includes money to lead to Bd of Ed formulation of "minimum performance standards" for "basic skill" of computer literacy, to be included in Student Assessment test required for high school graduation. Implementation date to be determined. Pre-service recommended.	1982 survey. In state's 67 districts, 8,000 micros total.	Educational Technology Section (ETS) (1981) supercedes function of Florida Educational Computing Project (FECP). ETS Instructional Consultants coordinate and supplement activities of DOE's several other involved divisions./Legislative 1983-84 allocation $16,635,000. Additional $2 million federal funds earmarked for micro purchase for voc. ed.	FECP organized, funded six Educational Computing Consortia (FECC) incorporating all local districts and post-secondary institutions. Meet monthly with ETS, serve as liaison, information exchange between individuals, districts, and ETS. FECC offer conferences, in-service training. ETS funds Florida Center for Instructional Computing (FCIC). Disseminates FCIC courseware reviews, indices, inventories, offers courseware review seminar. FCIC maintains library and micro labs at U. of S Florida. In 1983-84 ETS plans opening 10 regional satellite centers with micro labs, in-service training. ETS has electronic bulletin board, publishes 'Ed Tech News.' Several other involved divisions include Management Information Services which has microcomputer training and demonstration lab and Office of High Technology which promotes cooperation with industry. Annual computing conference co-sponsored by all divisions.
Georgia	No; but Bd. of Ed. considering proposals regarding student and teacher computer literacy requirements; in- and pre-service training are highly recommended.	January 1983 survey: Of 187 districts, 103 are offering instructional computing; 1,218 micros total.	Computer Instructional Consultant assists local school systems, coordinates with DOE subject area staff./Some state funding.	Organizing teacher training lab, will conduct one-week sessions for districts, teacher groups. Offers similar workshops at schools on request. Consultant develops software. DOE operates Georgia Software Library jointly with Georgia State University. Library's Division of Curricular Services provides list of available software, hardware, publications; offers recommendations; member, MECC. DOE plans two conferences for fall 1983. Hardware on state bid list.
Hawaii	No; 1983 legislation asserts schools' priority be that "all seniors receive computer awareness experience, though it would not be required for graduation." To be administered as 2-week lab unit in most cases	Ongoing inventory. August 1983: for 162,000 students 155 micros total.	Plan fall 1983 hiring of coordinator of instructional computing; presently, involved divisions in Office of Instructional Services share task./ Primarily state funding, some federal for specific curricular areas. Special funding necessary to implement senior awareness bill.	DOE "Training Design" addresses four phases of in-service: 1) orientation; 2) history, hardware evaluation, beginning hands-on; 3) programming, software evaluation; 4) curriculum implementation. Phases 1,2 have been piloted, plan pilot phase 3 this school year. Sub-districts also conduct similar in-service training. Annual curricular "institutes" hold workshops. DOE finalizing development of software evaluation process, form. Plan to compile "approved instructional materials" list. Considering establishment of sub-district resource centers open to teachers, students, community. Binding hardware contracts.
Idaho	No; but Bd. of Ed. has accepted Commission on Excellence recommendation that two of four math credits required for graduation may be earned in computer/calculator science. Effective 1984-85.	No figures available.	State math consultant spends percentage of time on computer concerns./No specific funding.	Reorganizing computer lab at DOE; expect to run workshops; hardware, some software, available for preview. DOE disseminates to districts list of non-affiliated in-service trainers. Revised mathematics curriculum guides to incorporate CAI information.

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Illinois	No; currently studying student requirements. Teacher requirements under revision; proposed computer literacy requirement for all teachers, more stringent for data processing/computer science instructors.	1981-82 survey: Of 1,013 districts, 803 (79.5%) responded. 36.2% of 353 elementary districts, 72.9% of 96 high school districts and 66.3% of 354 "unit" districts possessed micros.	Computer Technology Coordinator orchestrates activities of involved divisions regional Consortia Leads monthly meeting of Consortium Executive Board./$1 million state appropriation to be dispensed by DOE for consortium development over next two years.	In concurrence with Bd. of Ed sanctioned report. DOE is supporting statewide development of 18 regional Consortia; planned to be economically self-sufficient in two years. Each consortium will arrange programs and/or hire a consultant to meet 3-point goal: "acquisition of or access to hardware and to software, and access to knowledge on using both." Each consortium will develop special areas of expertise consistent with constituent interests DOE considering plans for statewide conference, CAI newsletter; hardware contracts.

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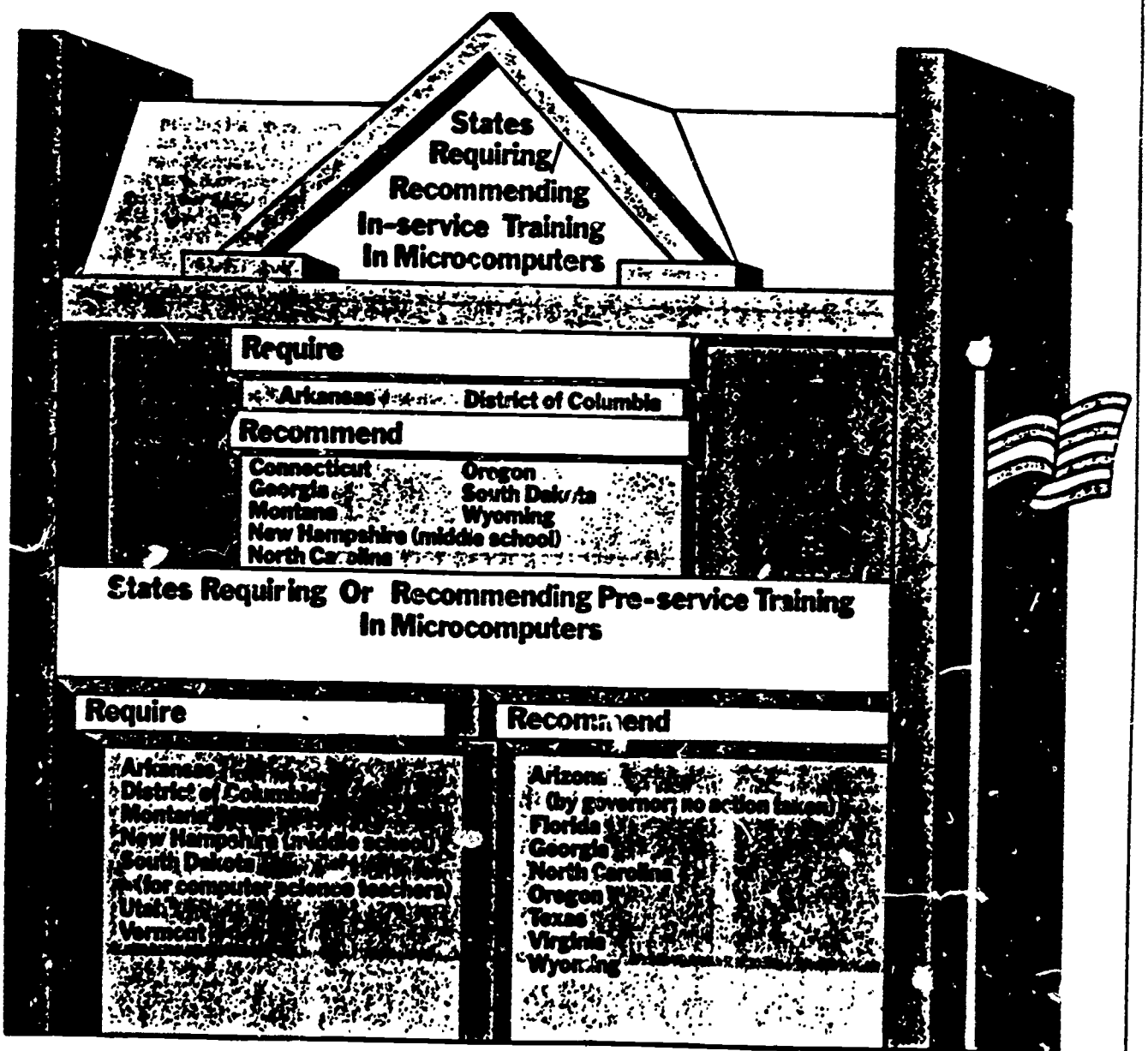

STATE GOVERNMENTS

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Indiana	Yes, April 1983; State Commission on General Education mandated that schools "will teach computer literacy," starting school year 1984-85. Districts given various options for implementation. Teacher training mandate under consideration.	1983 survey: 70% of 305 districts responded, 345 instructional computing projects reported.	Division of Federal Resources and School Improvement employs Consultant for Instructional Technology; in cooperation with other involved divisions, coordinates all state computing programs /State, federal funding. In 1983, $11 million state allocation for development of these programs, including regional clearinghouse/consortium.	As part of state's Educational Improvement Process (EIP), districts devise literacy programs choosing from options in DOE guidelines. DOE sponsors in-service workshops; goal is to train 5,000 teachers per year. Maintains Microcomputer Evaluation and Resource Center, over 200 software packages for testing, preview. Participating in development of Indiana Educators Information Network, statewide consortium networking nine regional clearinghouses; each with hardware and software collections; electronic mail; access to Indiana Human Resource File and to "CompFIL" (listing all computing projects in state); courseware evaluation information; in-service training programs. State hardware contracts. 1983 legislation allows state tax credit for donating hardware to schools.
Iowa	No	September 1982 survey. 2,782 micros for grades K-12.	Support group of DOE staff work with Coordinating Committee composed of teachers, district leaders, Area (regional) Education Agencies, private sector./No regular state level funding; $250,000 special allocation for clearinghouse project.	DOE takes "largely observer" role. State's 15 Area Education Agencies administer, carry out CAI activities including extensive in-service training; hardware, software services. DOE okays local hardware purchase. Grass roots groups, post-secondary institutions highly involved; 28 higher education institutions integrate pre-service CAI training in curriculum. DOE plans to fund central software clearinghouse opening July 1, 1984. Hardware contracts through Iowa Educational Computing Consortium.
Kansas	No; but some discussion; in September 1982 1-year initiative adopted to fulfill state's commitment to educational technology.	1983 survey: Of 306 districts, 301 use micros; total of 3,259 units in grades K-12.	Coordinator of Instructional Computing heads in-house computer committee comprised of involved division staff./State, federal funding	DOE efforts focus on hands-on in-service, software projects. Week-long workshops upon district request. Software disseminated through "computer van" project; clearinghouse opening fall 1983; plans dissemination of "available software" list. Also cooperates with two independent regional centers; in future may consider developing state-affiliated regional centers. Semi-annual statewide conference
Kentucky	No; but Bd. of Ed. action pending on draft guidelines for minimum basic skills, including 18 for computer awareness and use, assigned to specific grade levels 1-12; composed by DOE and districts. Teacher certification: revised pre- and in-service requirements likely by end of 1983-84 school year.	1982-83 survey: 1,370 instructional micros. Estimate over 2,000 at present; updated survey was due October 1983.	Each involved division has staff member with CAI as "auxiliary responsibility"; informal consultation between divisions. Office of Computer Services and Consultant for Instructional Computing handle technical, operational issues. Task forces used to address specific situations./Primarily state, some federal funding; math division has block grant money for micro purchase.	DOE soon likely to consolidate efforts, formulate state plan. Active in in-service: regional software training meetings, hands-on workshops, summer courses at state universities; all emphasize software selection. Share rights to EPIE materials with state Educational TV (KETV). Subject area divisions often administer training. 3-week intermediate course on computer use in Business Ed. to be initiated in 1983-84, taught by vendors. DOE distributes software information including EPIE, MicroSIFT reviews, through designated district computer contact. Conference on "Micros From an Instructional Software Basis" presented four times in 1982-83. Hardware contract; binding if district is participating in state program.

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Louisiana	No; but Task Force Position Paper recommends to Bd of Ed that "computer literacy be an integrated part of the total K-12 curriculum" with "all students . . . computer literate by completion of the 8th grade" and that curriculum guides reflect this integration. Also recommends that "computer science and data processing . . . be separate curricular components . . . offered as electives at the secondary level" Action pending.	April 1983 survey. Of 1,439 public and 393 non-public schools surveyed, 1,079 responded. 345 are using micros in instruction. 1,373 micros total.	Office of Research and Development houses Management Information System (MIS) which coordinates most DOE services. Task force represents beginning of "structure process" to "identify problems, changing needs."/In-service training MIS budget. Some grants for special projects	DOE offers hands-on awareness, literacy workshops to teachers, administrators. Instructional Computing Resource Center stocks hardware, software for preview; DOE plans Center's expansion to statewide network. Two state-funded Professional Resource Centers contain computing resource centers. 1982 review of computing in state's schools emphasizes commitment to further information distribution, participation in software development organizations. Bureau of Dissemination works with instructional computing material Member, MECC. Conducts annual statewide computer conference; also offers sessions at specialty area conferences. Hardware on state contract. Legislated tax incentive for hardware donations
Maine	No, but strong interest at local level.	Unofficial 1982 survey: Estimate 950 micros. Projected 2,000 micros by end of 1983-84 school year.	Educational Microcomputing Consultant coordinates Dept. activities. Task forces used to address specific situations./ Block grant funding.	DOE has provided districts with guidelines for development of in-service programs; approves district designs. Conducts brief awareness, literacy, and software evaluation workshops. Resource Center at DOE contains hardware, software. "Maine Micro Messenger" published quarterly; includes hardware, software product information. Grant project: "Information Exchange" lists resources available to localities. Planning statewide conference. Hardware contracts.
Maryland	No; but graduation requirement and curriculum revision task forces considering literacy requirements for students. Teacher pre-service: Up to three computing credits may be used towards math requirements. Professional Standards Board now addressing in-service literacy requirements	Fall 1982 survey. "Several thousand" micros in system. Library/Media services staff released updated survey, fall 1983.	Task Force on Technologies comprised of DOE, local Education Agency representatives; now formulating state policy. Library/ Media Services unit coordinates software evaluation./Block grant funding: 80% dispensed directly to local districts. State's operational budget minimal until definite policies set.	DOE will grant up to three in-service credits to teachers completing DOE-accredited district in-service courses. Provides advice, technical assistance to districts establishing such courses. Library/Media Services unit has developed on-line district software evaluation data base; also offers access to other data bases. Information disseminated through regular meetings with district supervisory personnel. Action on an educational research center and software clearinghouse projects postponed until Task Force delineates state policy DOE supports University of Maryland conference, and Maryland AEDS, hosting of 1983-84 national AEDS conference. Offers guidelines for hardware purchase.
Massachusetts	No; though Governor's task force and joint legislative committee plans to issue recommendations concerning technology in education, curriculum is locally determined.	Annual survey. June 1983 results not yet released. Estimated at least 9,500.	Bureau of Educational Resources and Television is "focus of information" for DOE activity. Involved divisions work directly with constituents. Technology in Instruction Committee, headed by Coordinator, meets monthly to facilitate inter-divisional contact./State, federal funding.	DOE activity limited by local curricular control. Commonwealth In-Service Institute, a DOE service, administers DOE grants in competitive funding for in-service programs proposed and formulated by districts. Awards average $3,000. DOE funds small vocational software resource center in Lexington. Expanding state's "Resource Bank" program fall 1983 to provide user networking; available at six Regional Education Centers. Cooperates in curriculum area conferences with focus on instructional technology.
Michigan	No; but the Michigan Project BEST Committee has submitted a position paper concerning student and teacher computer literacy recommendations. Action pending.	No figures available.	October 1983, DOE was to designate computing consultants in instructional, administrative areas; Technology Specialist to oversee./ Some state funding.	DOE believes increased local support of statewide action is imperative "before state is empowered to move." Presently drawing up "Voluntary Literacy Standards"; compiling training manuals for dissemination to local systems. Offers sessions in curriculum area conferences.

(Continued)

STATE GOVERNMENTS

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Minnesota	No; but Bd of Ed has officially stated that it "expects Minnesota schools will promote computer literacy through the various disciplines." Grant appropriation bill has same intent written in; includes "incentives" to promote excellence in local projects.	1982 sample survey of 25% of state's districts indicated 10,000 instructional computers statewide. Present estimate: 12,800. Comprehensive fall survey planned.	Supervisor of Curriculum Development coordinates all DOE instructional computing activities./State funding: $6 7 million literacy grant in 1983-84.	DOE provides four means of in-service support: 1) allocates $1 per student to fund district programs, 2) $200,000 allocated for advanced level regional, state workshops; 3) $120,000 allocated for ten "model sites," open to visiting teachers; 4) coordinated projects with Minnesota Educational Computing Consortium (MECC). Software library and resource center to open at DOE Jan. 1, 1984, five courseware, content specialists will evaluate all courseware received MECC software collection expected to double in 1983-84; distributed statewide and nationally. MECC's eight regional centers respond to locality needs, network information MECC sponsors yearly conference; offers hardware contracts.
Mississippi	No; but Bd. of Ed. is now reviewing DOE Position Paper which denotes computer literacy as a state goal; details literacy criteria; calls for district submission of integrated computer education plans. DOE currently reviewing teacher certification requirements.	Fall 1982; 420 micros reported in instruction and administration. Estimate number has tripled; update survey planned.	DOE Computer Education Committee consists of Computer Ed. Consultant, representatives from ten involved divisions./ Chapter II funding South West Development Lab in Austin is funding literature project.	Fall 1983, launching three projects: 1) regional workshops suiting local training needs at a variety of levels; 2) DOE lab for hardware, software evaluation, feedback to vendors, training in product evaluation; 3) "informational packets" disseminated through Supt.'s office: monographs on hardware/software purchase, staff development. S W. Lab has offered 2-year funding for writing and publication of monographs and in-service guidelines. DOE plans "Computer File" for district-to-district software networking. Co-sponsors conference with MECA (statewide user group). Hardware contract binding if state funds used.
Missouri	No; but fall 1983 review of high school graduation requirements will include discussion of possible computer literacy requirement.	No figures available.	Departmental Task Force on Computing coordinates DOE activity./Some state funding	DOE coordinators administer in-service workshops to districts throughout year. Summer 1983, DOE and local university jointly offered four one-week workshops on instructional management systems. Co-sponsor with Facilitator Center (FC) of "Drive in Conferences": one-day meetings on CAI, instructional management, literacy; four times per year. FC is federally funded, located at State Office Building; disseminates information on nationally validated programs, assists in DOE workshops. State hardware contract available.
Montana	No; but Bd. of Ed. reviewing school accreditation standards; will possibly include computer literacy in new requirements. Teacher pre-service mandate; As of July 1982, every new teacher must be able to use computers in his or her area of certification. In-service recommended.	December 1982 survey results: 550 of 700 schools responded. Of these, 538 were using computers, with 1,746 micros total (80:1 student/micro ratio). At time of survey, schools planned to purchase 747 additional micros.	Mathematics/Computer Ed. specialist coordinates DOE activities. Instructional specialists work directly with constituency on special projects./State funding for employee salaries.	June 1983 meeting attended by DOE, district, university, government, private industry representatives concluded with delineation of specific policy priorities and action plans. Presently DOE conducts in-service; short workshops on district request, often in conjunction with universities. Software at DOE resource center used for workshops, evaluation. Compiling software evaluation data base from state survey results. Legislative proposal to establish regional centers; initially state, later locally funded. Three computer conferences held in 1983. State agency hardware contracts.
Nebraska	No; though Legislative task force is investigating issue curriculum is locally determined This fall, issuing general guidelines for teacher "endorsement" in computer science.	March 1983 survey: 1,706 micros reported. Estimate at least 2,200 at present.	Involved divisions operate independently. Possible structural revision in near future./ State funding limited as 80% of state's educational funding derived on local level.	DOE activities restricted by funding limitations; does maintain electronic bulletin board, mail service, software catalog Nineteen independent Regional Educational Service Units cooperate with each other and with DOE; offer in-service programs, group hardware purchases. DOE has sponsored statewide conferences.

States With Computer Literacy Requirements

These three states and the District of Columbia have now passed requirements that students show minimum computer literacy skills by a certain grade level.

State	Level	Commencing
District of Columbia	9th Grade	1987
Florida	Graduation	To Be Determined
Rhode Island	Graduation	1984
Virginia	Graduation	1988

States Requiring Or Recommending That Schools Offer Students Exposure To Computers

Two states now require, and 12 more recommend that schools offer their students exposure to computers, either through specific computer literacy or science courses, or through the integration of the computer into the regular curriculum.

Requiring Computer Exposure

State	Form	Commencing
Indiana	Computer Literacy	1984
South Dakota	Computer Science	1986

Recommending Computer Exposure

Arkansas
Colorado
Delaware
Hawaii
Minnesota
Nevada
North Carolina
North Dakota (secondary schools)
Ohio
Oregon
Pennsylvania
Texas

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Nevada	No; but DOE's 1983 statement on graduation requirements "encourages Nevada schools to develop and offer coursework and instruction in the use of computers and calculators."	Results of first survey will be available January 1984.	Educational Consultant in Special Ed. coordinates DOE's activities as an extra responsibility./State funding earmarked for development of educational technology.	DOE opening Microcomputer Resource Center; collection of hardware and software available to schools for preview, loan. In conjunction, DOE will begin to offer in-service training. Has published software catalog, planning to negotiate hardware contract.
New Hampshire	No; but proposed secondary school minimum standards require schools to offer a half-year of computer literacy; student enrollment not required. Standards also express need to integrate computers into curricular areas. Pre-service: All new middle school teachers must meet certification standards in literacy; math teachers must also demonstrate "sufficient knowledge of a computer language."	Surveys conducted every three years list each school's micros; states how they are used. Estimate 90% of high schools in state now use 1,200 micros total.	Consultant for Mathematics Education coordinates computer education activities./ State funding for salary.	Consultant defines primary function as "broker"; helps districts gain contact with "freelance consultants" in educational computing. Encourages, facilitates NH ACES user group and university in-service programs; refers teachers to ACES software services; uses ACES newsletter. Hopes to organize "software available for preview" list. Cooperates informally with Hanover Regional Center. Co-sponsors (with ACES) a semi-annual statewide conference. Hardware contracts.

(Continued)

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STATE GOVERNMENTS

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
New Jersey	No; but investigation has begun on possible student requirements as well as teacher pre- and in-service requirements.	Planning fall survey, intended to identify needs, interests, expertise as well as resources and current use.	When feasible, Regional Curricular Service Units respond to district needs; otherwise, central office's Business/Vocational or General Academic Ed. divisions provide services. Gen. Ed. division maintains "Technology Unit" (July 1983). Final authority rests with Assistant Commissioner of Ed. Programs./Federal and state funding.	Services of General Ed division being consolidated into Technology Unit (TU), currently determining priorities. In fall 1983, co-sponsoring with state broadcasting network a cable telecast about literacy programs; corresponding workshops, software evaluation for local Bds. of Ed., teachers, administrators. Bus./Voc. division and professional educators' groups co-sponsor in-service workshops, arrange tours of computer-using businesses. TU presently deciding between emphasis on software evaluation networking or resource center. DOE's three regional centers provide preview, selection services; undergoing reorganization. TU plans to develop results of recent survey into user directory.
New Mexico	No; but now investigating possible student, teacher requirements	April 1983 survey, conducted by Univ. of New Mexico: 54 of 89 districts have some programs in schools; 301 micros total, for a 830.1 student/micro ratio	Data Management Coordinator handles DOE's activities./ State funding, for salary only.	Coordinator describes district attitude toward educational computing as "conservative." DOE considering instructional computing newsletter, computer resource center. Independent textbook division committee determines state software purchases; only programs on state list are available for preview. Coordinator hopes to set up computers at DOE and at school-book depository to facilitate preview of software on (and not on) state list.
New York	No; but student and teacher requirements under review.	Survey conducted April 1983: full report yet to be released, but estimates at least 25,000 micros being used for instructional purposes.	Center for Learning Technologies (CLT, 1982) administers, coordinates activities in primary, secondary, post-secondary and cultural institutions. Consults with Regents Advisory Council on Learning Technologies and representatives from public and private sector./State and federal funding; CLT preparing detailed budget to submit for legislative funding	CLT defines task as "coordinating efforts of New York's educational, cultural and business institutions to demonstrate how the new technologies can improve the learning process." DOE administers seven regional Demonstration and Technical Assistance Centers which provide in-service development and staffing (some for graduate credit); software and video production; information dissemination, assistance to schools in developing criteria and literacy programs; and identifying curricular areas likely to benefit from learning technologies. CLT acts as liaison between business and educational communities; working toward cooperative courseware production. Works with public TV, radio on CAI projects; publishes newsletter; researches and publishes on "current topics." Administers local assistance grants; networking with on-line "NYSNET" system. Plans to organize telecommunication conference between several states. Assists with negotiation of group hardware purchase.
North Carolina	No; mandate bill tabled in favor of suggested Bd. of Ed. State Plan for K-12 instructional and administrative computing; delineates three learning stages: K-5 (awareness); 6-9 (exploration); 10-12 (specialization). Calls for district submission of five-year plans. Plan "strongly recommends all teachers be computer literate"; DOE now developing pre- and in-service requirements.	Annual survey. June 1983 figures: more than 6,000 micros in state.	Computing Coordinator works with division directors in Educational Media/ Technology, involved divisions./State funding; seven technology block grants totaling $350,000, disbursed by DOE for district administration.	DOE's extensive in-service programs designed around feedback from workshops; frequently offered in cooperation with colleges. Other DOE workshops target principals, library media staff, specific curricular area groups. Produced TV series on computing, spring 1983. State Media Evaluation Center offers software reviews, recommendations; plans electronic dissemination of latter, possibly nationwide; by 1984 will have media specialists who will assist with staff development, in-service, hardware and software acquisition. DOE plans statewide electronic mail, bulletin board. Publishes newsletters "Micro Monitor" and "Media Matters." Binding hardware contracts with provisions for in-service training, servicing.

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
North Dakota	No; but Supt of Ed. may endorse Commissioner's Statement on Computer Education, which states goal of student familiarity with computer functions, use and ethics by end of ninth grade. Also recommends all secondary students develop proficiency in computer use in many curricular areas.	Will probably conduct fall survey; saw "dramatic purchasing this past year"; many districts buying 50-60 micros per year.	State Computer Committee (SCC, 1979, reorganized spring 1983)./State funding: some federal grant money for micro purchase	SCC intended to help schools with policy, program planning, grant proposals, hoping to direct university efforts in in-service training. Published micro guide, 1979. Member, MECC. 1982-83 administrator's conference devoted to instructional computing. State hardware purchase plan includes software/servicing package.
Ohio	No; but DOE's minimum required standards for elementary and secondary schools include the "strong suggestion" that computer science courses be provided in junior high school, and keyboard experience in high school. Planning fall discussion of preservice standards revisions.	June 1983 survey: 331 of 615 districts responded; 6,827 micros total.	Division of Ed. Services now hiring Consultant for Instructional Computing; will take over coordinating function of outgoing interdivisional task force./ Block grant funding; possible special grant for 1983-84.	DOE has written, disseminated district handbook for planning programs in instructional computing; topics include objectives assessment, hardware/software selection, in-service; new consultant will offer supplementary assistance. Opening computer center for software preview. Investigating potential for expanding DOE regional centers to provide assistance. Uses Supt.'s newsletter; now developing quarterly newsletter on available services. Annual Computer Fair/Conference.
Oklahoma	No; but 1982 "accountability" legislation requires districts to review, specify curricular activity, including instructional computing. Also calls for yearly submission of comprehensive staff development plan; includes in-service training.	Estimate 4,000 micros now in schools. Fall survey planned.	Instructional Computing Resources Section works cooperatively with involved divisions to provide in-service training, software assistance./ State budget line item; DOE will disburse over $800,000 this year to schools for pilot projects.	Summer 1983; sponsored "Caravan," five regional conference/workshops for awareness, idea exchange. "Skeletal" software preview library at DOE; intra- and interstate exchange of public domain materials; piloting project for public domain software development. State's 14 regional service centers may contain preview libraries by 1984-85. Developing electronic user network, bulletin board. Commercial software price information, authorized sales/service list available to schools.
Oregon	No; but one of the Bd. of Ed.'s priorities for 1982-85 is to "increase the use of technology for instruction, instructional management, and school program management."	Figures not available, but estimate at least one micro per school, or approximately 1,500.	Instructional technology division cooperates with Oregon Educational Computing Consortium (OECC, organized by DOE in 1981); coalition of state's 90 school districts./State funding for DOE staff salaries; programs supported by OECC funds. US DOE now funding in-service evaluation project.	DOE collaborating with universities on evaluation project; studying in-service in nearby states; will eventually select one and train regional representatives to implement in localities. OECC's primary function is software pooling; also publishes annual catalog.
Pennsylvania	No; but legislative resolution supports Bd. of Ed.'s proposed curricular requirement: that each student be computer literate by end of sixth grade. Bill recently introduced to fund hardware purchase and integrated K-6 literacy program as part of Basic Ed. budget.	Department estimate: 25,000 micros by 1984. 29 regional units to survey local tallies	Coordinator of Instructional Material Services (IMS; early 1970's) coordinates with directors of 29 regional IMS units; unit directors coordinate with constituents. DOE undergoing reorganization aimed at achieving closer contact between involved divisions./State funding.	No DOE masterplan; committee to recommend staff development. Districts, in cooperation with IMS units, will conduct 7,200 in-service courses in 1983-84. Units develop courses, assist districts in organizing and/or offering instruction. DOE approves courses offering graduate credit. DOE resource center publishes software/hardware evaluations, informs units about commercial releases. Libraries division resource center contrins other agencies' evaluations. DOE Bureau of Press and Communications directs Penn*Link, a statewide network offering extensive services. DOE's annual Technology in Curriculum conference features computer courses, hardware/software display. Urban Computer Camps offered summer 1983.

(Continued)

STATE GOVERNMENTS

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Rhode Island	Yes: high school graduation requirement of half unit of computer literacy starting 1984-85 Mandate to undergo review in January 1984.	November 1982 survey. 700 micros reported for 140,000 public school students	Coordinator of Technology in Education./ Federal funding. Governor's Technology in Education Initiative provides $4 million to DOE to fund district in-service training, equipment acquisition in 1984-85	Under Initiative program, districts submit proposals outlining plans for addressing four subjects: literacy, computer as medium of instruction, programming, computers in careers; detail software/hardware plans. DOE approves plan, contracts with universities for in-service training. If plan is not approved, field workers are sent to assist in restructuring. In-service training goal: Within three years 90% of all teachers will be "computer aware"; 40-50% "literate." Four in-service series offered on public TV. Organizing Resource and Training Center at state college. Maintains large software collection. Newsletter planned. Member, MECC. Percentage of Initiative funding will be divided between districts, according to enrollment, for hardware purchase from state contracts.
South Carolina	No; but 1983-84 special budget appropriation will fund computer education. Revised graduation requirement, effective class of 1987, allows one of three required math units to be earned in a computer ed. course. Teacher training requirements under review.	No survey available.	Vocational Ed. computing courses administered by that division; all other activities by General Ed. office./State funding. Special appropriation of $1 million to be disbursed by DOE to districts.	To acquire funds, districts must submit "needs assessment statement"; they use DOE-suggested outline in setting up teacher training and student introductory courses. DOE sponsors considerable in-service training: two-week courses for upgrading credentials, one and two-day seminars for teachers and administrators focusing on role of computing, hardware, software selection. DOE audio visual library may be enlarged to include public domain software for review, dissemination. San Mateo (CA) TEC's "Software Preview Guide" sent to all districts with South Carolina educators' recommendations. Electronic message system. State agency hardware contract.
South Dakota	Yes; coordinated secondary and post-secondary ma.. es: Board of Regents has decreed that all students enrolling in state's colleges must have taken at least one half-year of computer science in high school, effective 1987. Bd. of Ed. mandate states that at least one half-year computer science course be taught in all high schools by 1986. Teachers teaching any for-credit high school course must have at least eight hours graduate credit in computer science, four of these in a language; effective fall 1983.	1982 survey results: 158 of 184 districts responded; 148 reported using computers for instruction, with 1,800 micros total.	Technology Director (1982)./Federal funding. Preparing proposals for federal discretionary funds.	Recently approved State Plan delineates DOE policy. DOE now offers one to two-day workshops to meet district needs; sponsors regional conferences for teachers, administrators throughout academic year on any topic at school's request. Networks trainees with vendors, user groups offering courses; disseminates list of available courses. DOE Library contains public domain software for schools to copy; some commercial software available for preview. Planning to form either software review or abstracting service. Disseminates information about hardware selection; State Purchasing Office hardware contract.

States With A Computer Education Coordinator

Twenty-six states have created the position, with a variety of titles, for a coordinator whose responsibility is overseeing the continuing and expanding use of computers in schools for both instruction and administration.

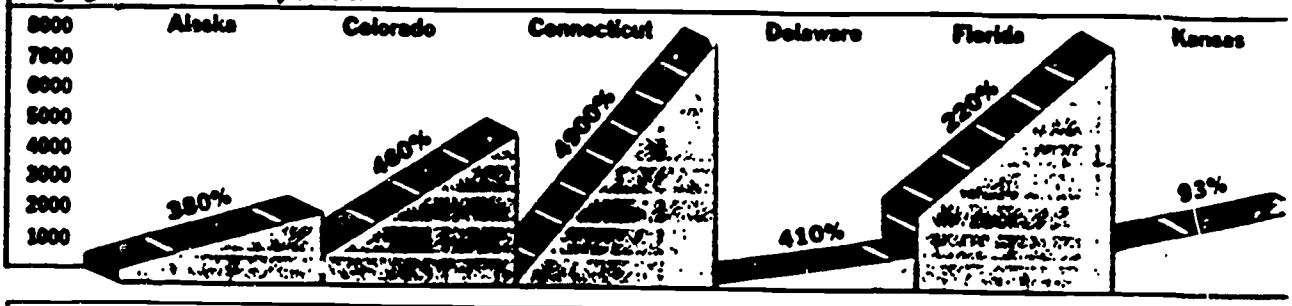
Alabama (2)
Arizona
Arkansas
Colorado (2)
Connecticut
Georgia
Hawaii
Idaho
Illinois
Indiana
Kansas
Kentucky
Maine
Massachusetts
Michigan (planned)
Minnesota
Mississippi
Montana
New Hampshire
New Mexico
North Carolina
Ohio
Pennsylvania
Rhode Island
South Dakota
Wisconsin
Wyoming

STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Tennessee	Pending; legislative action expected January 1984 on proposed "Better Schools Program" (Bd. of Ed.'s curricular revision, which includes mandate for seventh and eighth grade literacy program). Considering computer science graduation requirement.	December 1982: over 1,000 micros reported. New study scheduled for this fall.	Literacy program administered by "Computer Skills Next" coordinator. All other activities still under Research and Development (RD). Vocational and Special Ed. offices administer programs separately./ State and federal funding.	DOE offers in-service workshops on CAI, computer-managed instruction; disseminates in-service training guides. Establishing six regional software clearinghouses; expects them to form basis of user network. Member, MECC. Hopes to establish five regional labs with 15 micros each; otherwise place two micros in each of state's nine district service centers. Disseminates guide to micros. Sponsors full day conferences for districts, schools, local Bds. of Ed. Hardware contracts.
Texas	No; in mandated curriculum revision, Bd. of Ed. has outlined a new content area of computer literacy; now determining specific K-12 requirements. Teacher certification requirements under revision; Commission on Standards has recommended a three-hour literacy course be required.	Survey conducted by University of Texas: results not yet released	Instructional Computing Program (Sept. 1, 1983), cooperates with 20 Regional Educational Service Centers (ESC)./State funding, federal grants for some projects.	DOE, ESCs are now cooperatively forming "staff development network"; train regional computing consultants, provide training materials. DOE disseminates "Essential Computing Competencies for Texas Educators," a pre-, in-service handbook. DOE Microcomputer Resource Center provides DOE staff training, software/hardware review, information clearinghouse, graduate internship program. ESCs have on-line data base on statewide computer use. DOE funds "Texas Educational Computing Cooperative"; administers projects such as statewide courseware evaluation network, correlating packages to state's basic skills objectives.
Utah	No; but Bd. of Ed. now developing detailed curriculum standards for K-12 computer literacy. Pre-service: All new teachers must submit evidence from their certifying institution that they are computer literate.	Survey conducted by Center for Educational Practice, University of Utah, December 1983: Of state's 40 districts, 24 responded, (89% of total enrollment); 1,818 micros total.	Planning and administration under Unit of Instructional Technology; Information and Instructional Services provides technical services./Some state funding.	DOE provides in-service literacy training. Two-step statewide consortium development; September 1983, all districts, other interested groups have on-line access to software clearinghouse in central office; September 1984, seven regional centers will contain media materials, provide repair service, probably preview capacity. DOE plans instructional computing newsletter. Co-sponsors two technology conferences per year, in conjunction with Office of Higher Education. Hardware contracts.
Vermont	No; but may rewrite elementary and secondary school standards to include the provision that "computers should be used in the school curriculum." New teacher pre-service certification standards require computer competency in two areas of certification, including foreign languages, the sciences, social studies. Developing new "computer educator" category.	Annual survey: 1983 results: 50% response, reported 950 micros or terminals total	Involved division staff work with constituents. Director of Basic Ed. provides coordination when required./State funding for salaries; block grant funding for activities; $5,000 total.	DOE has written, disseminated "Computer Considerations for Vermont Schools"; contains overview of curricular uses of computer, guidelines for developing school computer plan, bibliographical references. In-service training often in conjunction with universities; summer 1983 week-long literacy workshops for districts. DOE offers small workshops year-round. Seven teacher "Resource Agents" teach colleagues. "Regional Teams" contain computer-aware staff member; help identify, assist schools in need. DOE coordinates user mail and electronic software exchange; publishes "Computer Bits" four times per year. Hardware contracts.
Virginia	Yes; literacy skills required for graduation, starting 1988. Bd. of Ed. is studying task force proposals for three levels of in-service training: 1) 16-hour "awareness" for all teachers; 2) 45-hour "utilization," of computer-assisted and managed instruction (goal: 50% of state's teachers in next five years); 3) 90-hour "specialization." Pre-service recommended.	March 1982 survey: 1,600 micros reported. Fall update planned.	Division of Instructional Media and Technology coordinates most programs, meets every two months with advisory committee composed of involved division representatives./State funding; operating budget is $400,000.	Division beginning to develop in-service training plan; drawing up guidelines for localities to effectively use $70,000 yearly allocation; arranging to supply equipment. DOE Technology Examination Lab now compiling software collection, exploring possibilities of establishing evaluation consortium. Provides MicroSIFT, other evaluations. Meets with local planning committees to advise on software/hardware acquisition. Uses Supt.'s memos to disseminate information; expects to establish radio information station soon. Conducts seven regional one-day principals' institutes; six annual "Media Congresses." Planning annual conference. State government hardware bid list; recent legislation provides tax incentive for hardware donations. *(Continued)*

STATE GOVERNMENTS

Estimated Growth Rate In Number Of Microcomputers In Schools, 1981-1983

Over the past two years in these six representative states, the number of micros in schools grew at rates ranging from 93% to nearly 5000%.



STATE	MANDATE	STATEWIDE USE	STRUCTURE/ FUNDING	COMMENTS
Washington	No; but student requirements, teacher certification are being studied	No figures available from DOE.	Unit in Computer and Technological Ed Programs (July 1, 1983)./State appropriations for 1983-84: $1.6 million for regional centers, $400,000 for Pacific Science Center, $236,000 for establishment of Unit.	DOE establishing five (four full and one mini) Educational Service and Demonstration Centers (ESD) across state. Will offer in-service training and advising, network potential trainees and user groups, vendors, post-secondary institutions offering courses; will have software and hardware preview capacity. Member, MECC. Data Processing Authority hardware contracts.
West Virginia	No, but "Master Plan for Excellence (pending budgeting) states that "computer literacy will be taught in the middle school years" and that "all students will have access to technology."	May 1983 survey: computers used for instruction in 495 sites in state, with total of 1,352 machines reported.	One staff member acts as state liaison. State Task Force on Technology is working on "major concerns." State has allocated $750,000, additional $600,000 allocation from the Appalachian Regional Commission, for development of voc. ed. programs.	DOE now developing computer literacy objectives; compiling self-training, staff development packages to assist districts. Adding computer labs to 17 vocational resource centers; expects expansion at all centers; hopes to add General Ed. software within two years. DOE disseminates to districts any software information received, including MicroSIFT evaluations. Participates in several conferences held with special interest groups. One of state's Regional Education Service Agencies is member of MECC.
Wisconsin	No. Pre-service: Computer science certification available on completion of state approved program. Grandfather clause allows secondary school math teachers to qualify for certification if they have taught at least two semesters of computer science; applicable through 1985.	May 1983 survey: 97% of K-12 schools use micros. 6,525 micros total in system; additional 1,103 on order.	Supervisor for Microcomputers and Instructional Technology (July 1, 1983) coordinates DOE activities./Some state funding	Now developing guidelines to help local districts incorporate computers into curriculum. Assist districts, regions in planning in-service program on request, but small staff usually limits assistance. In spring, offers short "Computers in Education" course. DOE plans to develop central or regional library in next year or two. Cooperates with Wisconsin Instructional Computing Consortium (WICC); member, MECC. WICC often acts as liaison with schools. DOE plans electronic mail, bulletin board. Participates in user, professional organization conferences. WICC maintains hardware contracts. Legislative proposal would provide tax incentive for hardware donations.
Wyoming	No; curriculum locally determined. At Supt.'s request, DOE has formulated and is implementing a five-year State Plan for teacher training. In-service and Pre-service recommended.	DOE estimates 1,000 micros; all 71 high schools in state have micros.	Coordinator of Science, Math, Environmental and Computer Ed. carries out most DOE activities. Involved divisions work directly with constituents./Some state funding.	DOE takes advantage of "unique" relationship with University of Wyoming; offers five-year in-service plan in cooperation with university's Science and Math Teaching Center. DOE administers awareness, literacy levels; university conducts "Leadership Program": Teachers with prior computer knowledge study software evaluation, computer assessment; receive credit, return to localities to teach colleagues. DOE maintains public domain software bank; provides districts with copies. Disseminates catalog of commercial software, maintains small collection. Offers guidance in hardware purchase; maintains hardware contracts.